Fishery Data from Phillips Bay, Yukon, 1985

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by

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This is the 10th Data Report
from the Central and Arctic Region, Winnipeg

PREFACE

This study was funded by the Northern Oil and Gas Action Program (NOGAP) through the Department of Fisheries and Oceans, Central and Arctic Region. It is one of a series of projects being executed under NOGAP B.2 to provide background data for assessing the implications of hydrocarbon development and production on critical estuarine and marine habitats of the Canadian Arctic Coastal Shelf. This document constitutes NOGAP Report B2.29.

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ABSTRACT

Bond, W.A., and R.N. Erickson. 1987. Fishery data from Phillips Bay, Yukon, 1985. Can. Data Rep. Fish. Aquat. Sci. 635: v + 39 p.

Fish populations in the vicinity of Phillips Bay, Yukon coast, were sampled from 29 June to 21 August 1985 with variable mesh gillnets and small mesh seines. Seven anadromous species comprised 75% of the total catch. Among the anadromous species, Arctic cisco (Coregonus autumnalis) was the most abundant (77%), followed by least cisco (C. sardinella) (16%), rainbow smelt (Osmerus mordax) (5%), and Arctic charr (Salvelinus alpinus (2%). The only marine or brackish water species captured in significant numbers were fourhorn sculpin (Myoxocephalus quadricornis) which accounted for 85% of fish in this group and Arctic flounder (Liopsetta glacialis) (14%). Catch statistics, associated water temperature and salinity figures, and biological data (length, weight, age, maturity, condition, food habits) are summarized in this report.

Key words: Yukon coast; Beaufort Sea; fishery surveys; anadromous coregonids; marine species; catch/effort; scale age; growth; sexual maturity; food habits.

RÉSUMÉ

Bond, W.A., and R.N. Erickson. 1987. Fishery data from Phillips Bay, Yukon, 1985. Can. Data Rep. Fish. Aquat. Sci. 635: v + 39 p.

Des échantillons ont été prélevés du 29 juin au 21 août 1985 parmi les populations de poisson dans les environs de la baie Phillips, le long de la côte du Yukon; pour ce faire, des filets maillants ayant des mailles de grandeur variable et des seines à petites mailles ont été employés. De tous les poissons capturés, les sujets de sept espèces anadromes représentaient 75% du total. Parmi les espèces anadromes, le cisco arctique (Coregonus autumnalis) était le plus abondant, avec 77% des prises, suivi du cisco sardinelle (C. sardinella) avec 16% de l'éperlan arc-en-ciel (Osmerus mordax) avec 5% et de l'omble chevalier (Salvelinus alpinus) avec 2%. Les seuls poissons d'eau de mer ou d'eau saumâtre capturés en quantité significative étaient le chabot-sseau à quatre cornes (Myoxocephalus quadricornis), qui constituait 85% des prises, et la plie arctique (Liopsetta glacialis), 14%. Les statistiques des prises, les chiffres pertinents sur la salinité et la température de l'eau ainsi que les données biologiques des sujets (longueur, poids, âge, maturité, condition, régime alimentaire) sont présentés dans ce rapport.

Mots-clés: Côte du Yukon; mer de Beaufort; études pour les pêches; corégonidés anadromes; espèces marines; prises/effort; scalimétrie; croissance; maturité sexuelle; régime alimentaire.

INTRODUCTION

The fishery resources of the lower Mackenzie River and southern Beaufort Sea (Fig. 1) are of considerable cultural and economic significance to the residents of the area.

For this reason, proposed industrial developments, such as hydroelectric projects in the upper Mackenzie watershed, pipelines through the river valley, and hydrocarbon exploration in the Beaufort Sea, have resulted in concerns over their potential negative impact upon fish and fish habitat. In response to these concerns, numerous studies have been funded by government and industry during the past fifteen years, resulting in a substantial improvement in our understanding of the resource and its habitat requirements.

Most of the research effort to date has been directed toward the Mackenzie Delta proper (Hatfield et al. 1972; Stein et al. 1973a, b; Jessop et al. 1974; Jessop and Lilley 1975; Percy 1975; de Graaf and Machniak 1977; Taylor et al. 1982; Chang-Kue and Jessop 1983) and the areas east of the delta along the Tuktoyaktuk Peninsula (Galbraith and Hunter 1975; Bray 1975; Jones and den Beste 1977; Byers and Kashino 1980; Bond 1982; Hopky and Ratynski 1983; Bond and Erickson 1982, 1985; Lawrence et al. 1984). A few studies (Craig and Mann 1974; Mann 1974; Griffiths et al. 1975; Kendel et al. 1975) have focused on Yukon coastal waters, but by and large, fish utilization of Yukon coastal habitats has been little studied.

Recent proposals for industrial developments on the Yukon North Slope (at Stokes Point and King Point) have underscored the need for the Department of Fisheries and Oceans to improve its data base on the fishery resources of that region. The present study seeks to address that requirement.

Data presented in this report were gathered during summer, 1985, from coastal waters in the vicinity of Phillips Bay, Yukon, as part of the Critical Arctic Estuarine and Marine Habitat Project (B.2) of the Northern Oil and Gas Action Program (NOGAP). Results of the second phase of the study, a trapnetting operation conducted in summer, 1986, will appear in a subsequent report.

MATERIALS AND METHODS

A field camp was established at Phillips Bay, near the mouth of the Babbage River (Fig. 2), on 24 June 1985. At that time the Babbage estuary was ice-free, open water extending west to the mouth of the Spring River and half way along Kay Spit to the east. Phillips Bay was essentially ice-free by mid-July although windblown ice was present throughout the study period.

The fish populations of Phillips Bay were sampled from 29 June to 21 August using gillnets and small mesh seines on a regular weekly basis (Table 1). Water temperature, salinity, and conductivity were determined at the time of each fishing effort.

FISH SAMPLING

Capture methods

The gillnets employed in this study were 60 m long by 1.8 m deep and consisted of equal lengths of 3.8, 5.1, 6.4, 7.6, 8.9, and 10.2 cm braided nylon mesh (stretch measure) seamed together. These were set at weekly intervals at eight inshore and five offshore locations. One additional station (Site 21) was established in the inner estuary (Fig. 2).

Inshore gillnets were tied to and run perpendicular to the shoreline with the smallest mesh closest to shore. A 1 m gap was left between the net and the shore to prevent fish being funnelled into the net at the shoreward end (Craig and Haldorson 1981). At most inshore locations, gillnets fished virtually the entire water column throughout their length. Set times at these stations varied from 45 to 135 min but most sets were of 60 min duration. Short set times were considered desirable because of the large numbers of fish encountered at shoreline locations.

The five offshore stations (Fig. 2) were situated at the 5 m isobath, their distance from shore ranging from 0.5 to 1.5 km. These sites were fished on the bottom for periods of 60 to 1315 min, but usually for about 120 min.

Eleven sites (Fig. 2) were sampled weekly with seines constructed of 3 mm nylon Delta mesh. The net used during the first cycle was 9.1 m long; however, in subsequent sampling periods a 4.6 m long seine was employed. On each occasion the total length of shoreline seined was measured and recorded.

Catch data from gillnets and seines have been described in this report in terms of absolute numbers, as percentages, and as catch-per-unit-effort (CPUE). For gillnets, CPUE has been expressed as number of fish per net per hour. CPUE for seines is expressed as number of fish captured per 100 m of shoreline seined.

Treatment of samples in the field

Fish captured in gillnets were retained for complete biological analysis as described below. For seine hauls the entire catch was usually retained for identification and analysis; but large individuals were simply measured and released. Retained fish were fixed in 10% formalin and transferred later to 40% isopropyl alcohol.

Biological analysis

Small fish captured in seines were measured (±1.0 mm) and weighed (±0.01 g) or simply measured. Small Arctic and least cisco were examined in some detail in an effort to determine the time of scale formation and to verify the occurrence of age groups 0, 1, and 2. The food habits of these small fish had not been

examined at the time of writing.

Depending on caudal form either fork length or total length (±1.0 mm) was recorded for gillnetted fish, and body weight (±1.0 g) was determined by means of an electronic balance. Sex was determined by examination of the gonads and a qualitative description of the degree of gonadal development was performed according to the following scale.

Female	Male	
1	6	Immature
2	7	Maturing
3	8	Mature
4	9	Ripe
5	10	Spent
0		Sex Indistinguishable

In order to provide a more quantitative assessment of the degree of sexual development and to supplement the above subjective evaluation, gonads of Arctic charr and coregonids were removed and weighed fresh (±1.0 g). The data on body and gonad weight were then used to determine the gonadosomatic index (GSI) by the formula:

$$GSI = \frac{\text{Gonad Weight} \times 100}{\text{Fish Round Weight}}$$

Scales and sagittal otoliths were retained for age determination of coregonid fishes while otoliths alone were taken from all other species. Age determinations performed to date have been limited to scale ages of the coregonids. Several scales from each fish were cleaned in a sodium hypochlorite solution (Javex) and mounted between two glass slides; the annuli were then counted with the aid of a microscope. The assigned age was equal to the number of completed annuli except for fish captured in June and early July which had not yet laid down their new annulus. In such cases the fish were credited with an additional annulus.

Food habits were evaluated initially by a gross examination of stomach contents in the field. This procedure identified the relative degree of fullness as well as some of the major food items. A limited number of stomachs, selected because they obviously contained food, were preserved in 10% formalin for further detailed analysis. In the laboratory the contents of these stomachs were removed and the food items separated into major taxa. Unidentified material or debris were combined into a further category called "residue". After separation into categories the organisms were placed on absorbent paper to remove excess moisture and the wet weight (±0.01 g) was determined using a Mettler PL 1200 balance. To date, stomach analyses have been completed for Arctic cisco, least cisco, Arctic charr, fourhorn sculpin, rainbow smelt, and saffron cod captured in gillnets.

During the course of food habit analysis a number of parasites were encountered and retained. As well, gills of a few Arctic cisco and Arctic charr and some ectoparasites from the fins of these species were retained in the field. All parasite material has been turned over to Mr. L. Bernier, Lorette, MB, for identification.

Weight-length relationships for the various fish species were described by the power equation:

$$\log_{10}W = a + b\ (\log_{10}L)$$

where W = weight (g)
L = fork or total length (mm)
a = y-intercept
b = slope of the regression line

Relative condition factors (K) were determined from the formula:

W = weight (g)
L = fork or total length (mm)

PHYSICAL AND CHEMICAL

Water temperature, salinity, and conductivity were determined in association with each fish collection. Readings were obtained at each shoreline station and at surface and bottom for each offshore site. Water temperatures were recorded in the field by means of a Model 42 YSI telethermometer or a pocket thermometer. Water samples were transported directly to the field laboratory in 1 L nalgene bottles where salinity and conductivity were determined using a Model 33 YSI meter. Meter readings were checked throughout the sampling period against prepared samples of 5 and 20°/$_{oo}$ salinity.

RESULTS

PHYSICAL AND CHEMICAL

Water temperature, salinity, and conductivity data collected at each location during 1985 are shown in Table A1.

Water temperature and salinity remained fairly constant in the study area throughout July but became highly variable in early August as strong winds acted on an increasing expanse of open water. The most dramatic variation occurred following two days of very strong east winds on 6-7 August. At that time the relatively warm, less saline water lying close to shore was blown seaward and was replaced by cold, saline seawater from offshore.

Such action sometimes produced substantial differences in temperature and salinity between stations separated by spits. For example, on 8 August, water temperatures on the inside of Kay Spit were 9.7 and 9.0°C at Sites 8 and 10, respectively, while at Sites 7 and 9 on the seaward side, water temperatures were 1.8 and 3.0°C. The salinity differential across the spit at the same time was 10.9°/$_{oo}$ at the west end and 16.4°/$_{oo}$ at the east end. Similar differences were recorded in August between Site 1 on the inside and Site 2 on the seaward side of Niakolik Point.

Overall, temperatures at inshore locations varied from 0.9 to 13.2°C while salinity readings ranged from 0.0 to 28°/$_{oo}$. The warmest, freshest water was generally found at Sites 1, 2, and 21, reflecting, no doubt, the influence of the Babbage River. No salinity reading greater than 6.6°/$_{oo}$ was recorded at any inshore station prior to 6 August. Until that date, mean temperature and salinity values for all inshore locations were 7.8°C and 3.0°/$_{oo}$, respectively. The corresponding mean values for the period 8-21 August were 6.4°C and 14.1°/$_{oo}$.

Water at offshore stations tended to be colder and more saline than that found near shore. Similarly, water at 5 m depth tended to be colder and more saline than surface water at offshore sites. Surface temperatures at these sites ranged from 1.5 to 9.0°C while at 5 m, temperatures varied from -0.7 to 7.0°C. Salinity values ranged from 0.9 to 26.0‰ at surface and from 3.3 to 29.9‰ at the bottom.

FISH

Fourteen fish species representing eight families (Table 2) were identified from catches at Phillips Bay in 1985, but only six had a frequency of more than 1% in the overall results (Table 3).

Seven anadromous species comprised 75% of the total catch. Within this group Arctic cisco was the most abundant (77%), followed by least cisco (16%), rainbow smelt (5%), and Arctic charr (2%). Broad whitefish, lake whitefish, and inconnu, common in the Mackenzie Delta and in coastal habitats east of the Mackenzie, were captured only in small numbers.

Among the marine or brackish water forms taken, only fourhorn sculpin (85%) and Arctic flounder (14%) occurred in significant numbers. Saffron cod (n=22), Pacific herring (n=1), and Pacific sand lance (n=1) were the only other marine species captured.

Inshore gillnetting stations were much more productive of fish than offshore sites (Tables 3 and 4), a phenomenon reported repeatedly in studies of Beaufort waters (Kendel et al. 1975; Griffiths et al. 1975, 1977; Bond 1982) Inshore sites produced 97% of the total gillnet catch during the study with an overall mean CPUE 43.7. By contrast, the combined CPUE at offshore stations was 1.0. Broad whitefish, lake whitefish, and inconnu were never captured at offshore stations.

The total catch of each species in small mesh seines for each sampling location is summarized in Table 5. Four species, Arctic cisco, least cisco, fourhorn sculpin, and rainbow smelt, were captured at all 11 seining locations. Complete catch data, indicating the number of each species captured, its frequency of occurrence, and its CPUE by location in each sampling period, are presented in Appendices A2 and A3 for gillnets and seines, respectively.

Table 6 indicates the ranges of temperature and salinity at which the major fish species were captured during the study.

Arctic cisco

Relative abundance and distribution: Arctic cisco was by far the most abundant species captured during the study, accounting for 53.0% of the total gillnet catch and 60.7% of all fish taken in seines. Although captured at all gillnetting stations except Site 12, their affinity for coastlines was very evident (Table 4). Even at Site 21, located just 300 m offshore in the inner estuary, the mean CPUE for this species was considerably lower (6.5) than the combined mean for the eight shoreline sites (25.8).

Large Arctic cisco were present in the study area at the outset of sampling and remained abundant until 21 August when fishing terminated. The largest single gillnet catch occurred 15 July at Site 5 where 157 cisco were captured in a 45 minute set. This large catch resulted in a mean CPUE at inshore sites during cycle 3 of 41.1 Arctic cisco. Otherwise, overall CPUE values remained fairly constant throughout the summer as mean values within sampling periods ranged from 17.9 in cycle 1 to 27.8 in cycle 7.

The use of mean overall values masks the differences that were evident in CPUE between sampling sites within time periods and at individual locations in different periods (Appendix A2). At Site 2, for example, CPUE remained between 6.0 and 20.0 from 29 June to 11 August but increased to 38.0 and 49.0 in the last two sampling periods. In cycle 4 (22-28 July) steep declines in CPUE were recorded at Sites 3, 4, 5, and 6 while, at the same time the CPUE at Site 9 on Kay Spit increased sharply to 72.0.

While these observed fluctuations in CPUE suggest movement on the part of the fish, we do not feel that further interpretation of the data is justified at this time. Undoubtedly, fish were moving in both directions along the coastline. On 10 July, it was apparent that all Arctic cisco (n=59) captured at Site 6, had entered the net from the east side, heading in a westerly direction. On 24 July, by the same reasoning, Arctic cisco captured at Site 9 (n=78) were travelling southwest along Kay Spit while those taken at Site 7 (n=20) were moving in the opposite direction. CPUE values in our gillnets were also affected by onshore-offshore movement that occurred in response to turbulence in inshore areas. Fish tend to move offshore when water conditions near shore become rough (Craig 1984). Such a reaction by the fish to the effects of strong onshore winds was evident to us at Site 9 on 16 July when all Arctic cisco (n=15) were captured in the half of the net farthest from the shoreline.

Virtually all Arctic cisco captured in seines were young-of-the-year. Members of the 1985 year class did not appear to be present in the study area at the commencement of sampling. They were first captured on 12 July when 18 individuals were taken at the four Kay Spit locations. Their abundance in the study area

peaked in cycle 6 when seines produced a mean CPUE of 137.5, then decreased sharply in cycles 7 and 8. The largest single catches in small mesh seines occurred 13 July at Site 1 (n=209), 26 July at Site 66 (n=411), and 10 August at Site 1 (n=973).

Age and growth: Arctic cisco captured in gillnets ranged in fork length from 169 to 460 mm with the majority (73%) being between 325 and 399 mm (Table 7). The modal length interval (350-374 mm) did not change over the course of the study. While seines produced Arctic cisco in the range 19 to 441 mm, most (98%) were less than 75 mm (Table 8). Cisco in the size range 100 to 299 mm were rarely captured, representing only 5% of the combined catch in gillnets and seines.

Age and growth features for Arctic cisco captured at Phillips Bay in 1985 are summarized in Table 9. Table 10 shows the length-frequency distributions for fish in each age group.

Arctic cisco ranged in scale age from 0+ to 12 years. Young-of-the-year (0+) obviously occurred in large numbers while the majority of gillnetted fish appear to be ages 6 to 9. The poor representation of fish between 100 and 299 mm suggests that few 1- to 5-year-old cisco were present.

The first young-of-the-year cisco arriving in the study area (12-13 July) ranged from 19 to 52 mm in length with a mean value of 34 mm and a modal length in the 30-34 mm range. By the end of our sampling period, the modal length interval had increased to 50-54 mm (Table 11).

We found no scales on Arctic cisco smaller than 35 mm. These apparently form when the fish has reached a length of 35-40 mm as reported by Redkozubov (1968) for the Baikal omul (C. autumnalis migratorius). In our samples, individuals between 35 and 40 mm usually had from 0 to 3 completed circuli on their scales. The largest young-of-the-year cisco examined (60-73 mm; 14 August) had 5 or 6 completed circuli. Arctic cisco in our area appear to complete approximately 7 to 10 circuli prior to formation of the first annulus.

Remnants of the embryonic fin fold were still present on small Arctic cisco captured in the early part of the study. The fin fold had usually disappeared by the time the young fish had achieved a length of 40 mm; however, traces of this structure were observed on individuals as large as 48 mm.

Recently, the theory has been advanced (Gallaway et al. 1983) that the Arctic cisco population of the Colville River, Alaska, is sustained by Mackenzie River fish which migrate to the Colville as yearlings and return to the Mackenzie to spawn upon attaining sexual maturity. To date there has been little hard evidence to substantiate the theory. Information gathered during the present study and during other investigations along the north slope in 1985, however, suggests that a migration of young Arctic cisco may in fact occur from east to west.

As noted, age 0+ Arctic cisco arrived at Phillips Bay on 12 July 1985 and their abundance peaked at this location during the period 5-11 August. Subsequently, young cisco were captured at Kaktovik lagoon beginning in the last week of July and at Prudhoe Bay starting 16 August (Mr. T. Nelson, Envirosphere Co., personal communication, 18 October 85). Their appearance at the Colville River was documented on 26 August (Mr. L. Moulton, Entrix, Inc., personal communication, 21 November 85). While certainly not considered conclusive, this sequence of events represents attractive evidence in support of the theory of a westward migration of Arctic cisco underyearlings between the Mackenzie and Colville rivers.

The mathematical relationship between fork length and body weight for Arctic cisco captured at Phillips Bay is described by the equation:

$$\log_{10} W = 3.2383 (\log_{10} L) - 5.6128$$

Analysis of covariance indicated no significant difference ($P>0.05$) between the slopes ($F=0.0102$; $df=272$) or adjusted means ($F=0.0035$; $df=273$) of the weight-length regressions for males and females (Table 12).

Sex and maturity: Male Arctic cisco outnumbered females by a wide margin throughout the study period, accounting for 61.5% of all fish for which sex was determined (n=1734). The male:female ratio of 1.60 was significantly different from unity ($\chi^2=92.28$; $P<0.005$). The most pronounced differential was observed during cycle 4, where males comprised 71% of the sample (n=208).

Most Arctic cisco were either immature fish or mature non-spawners. Only 7% of the males and 16% of females were judged capable of spawning in 1985 (Table 13). Interestingly, females accounted for the majority (58.7%) among mature spawners.

Several female cisco (n=5) were observed in which the coelom contained retained eggs from the previous year's spawning (1984). In one case, it appeared that the body cavity contained virtually the entire complement of eggs, the abdomen being distended by their presence. It was clear from the condition of the new ovary that these fish would not spawn in 1985. Furthermore, the new ovary in these fish was similar to that seen in many female Arctic cisco during the summer, suggesting that many of the cisco we observed were mature non-spawners, which had moved into coastal waters to forage during the summer.

Gonadosomatic indices (GSI) for mature spawning females (n=75) ranged from 1.90 to 8.46 with a mean of 3.60. Egg diameters for a sample of these fish (n=23) varied from 0.5 to 1.25 mm with a mean of 1.0 mm. In the case of mature males (n=38) the mean GSI was 0.91 with a range of 0.65 to 1.84.

The youngest mature Arctic cisco examined during the study were age 6 (328 mm male) and age 7 (314 mm female). Most mature spawners were more than 350 mm in fork length with males

tending to mature at a slightly smaller size (Table 13). Among mature fish, 98% of females and 79% of males were longer than 350 mm.

Food habits: A total of 845 Arctic cisco stomachs were examined of which 490 (58%) were empty or contained just a trace of food. A detailed examination of 71 stomachs in the laboratory showed the diet to consist primarily of Amphipoda, Mysidacea, and Copepoda which accounted for 39, 30, and 14% of the food, respectively, in terms of wet weight biomass (Table 14). Fish occurred in 39% of the stomachs examined, accounting for 4% of the total food biomass. Fish species identified from the stomachs of Arctic cisco included fourhorn sculpin, Pacific sand lance, and Arctic cisco.

Least cisco

Relative abundance and distribution: Least cisco are considered to be less migratory than Arctic cisco and have a more restricted distribution in coastal habitats (Craig 1984). In the present study least cisco made up 22.3% of the total gillnet catch and accounted for 5.1% of all fish taken in seines (Table 3). Only six individuals were captured at offshore stations for a combined CPUE of 0.06. This compared with mean values of 3.4 at Site 21 and 11.0 at the eight shoreline locations. Kendel et al. (1975) reported least cisco to comprise 33 and 61% of the total gillnet catch at Phillips Bay in 1974 and 1975, respectively.

Large least cisco were common in the study area from late June until early August but their general abundance decreased sharply after cycle 5. During cycle 5 (29 July - 4 August) ciscoes were abundant at all shoreline locations with a mean CPUE of 27.7 for the period. The combined mean for the eight sites fell to 6.9, 4.4, and 1.5 in cycles 6, 7, and 8, respectively. The largest single gillnet catches were made on 18 July at Site 7 (n=49), and on 23 July (n=47) and 3 August (n=65) at Site 6.

Small least cisco were not common in the study area. Apart from the 83 fish taken 10 August at Site 1, seines captured least cisco sporadically and in small numbers.

Age and growth: Fork lengths of least cisco captured at Phillips Bay in 1985 ranged from 25 to 356 mm. The majority were either 25-74 mm (19%) or in the 250-324 mm range (62%). Only 2% of all fish captured in gillnets and seines were in the 75-174 mm length range (Tables 8 and 15).

Age and growth features for least cisco are summarized in Table 16. Table 17 gives the length-frequency distribution for fish in each age group. Scale ages for least cisco ranged from 0+ to 11 years. Most fish captured in seines were young-of-the-year while, considering size as an indication of age, most taken in gillnets were age 6 to 9.

Young-of-the-year least cisco were not captured until 24 July when six, having a mean length of 34.5 mm (25-46 mm) were taken at Site 9. No fry were captured west of Site 2 until 9 August when they were taken at Sites 3 (n=20), 4 (n=3), and 6 (n=17). They were not found at Site 5, our most westerly station until 13 August (n=11). Young least cisco captured between 10-21 August (n=108) had a mean fork length of 48.7 mm, ranging from 31 to 68 mm.

The overall mathematical relationship between fork length and body weight for least cisco taken at Phillips Bay during 1985 is described by the equation:

$$\log_{10}W = 3.3836\ (\log_{10}L) - 6.0081$$

There was no significant difference ($P<0.05$) between the slopes ($F=0.0097$; $df=186$) or adjusted means ($F=0.7970$; $df=187$) of the weight-length regressions for males and females (Table 12).

Sex and maturity: Among least cisco, females outnumbered males, accounting for 67.2% of fish for which sex was determined (n=714). The sex ratio was significantly different from 1:1 ($X^2=84.76$; $P<0.005$). Eleven percent of males and 19% of females were considered capable of spawning in the current year (Table 18).

The gonadosomatic index was determined for 62 mature females between 277 and 352 mm in fork length. Values ranged from 1.56 to 10.45 with a mean of 4.36. Mean egg diameter for nine mature females was 1.0 mm (0.9-1.3 mm). The GSI for 19 mature males between 277 and 326 mm in fork length varied from 1.18 to 2.80 with a mean of 1.68.

Mature females (n=18) ranged in age from 7 to 10 years while mature males (n=5) were 7 to 9 years old. The smallest mature male observed was 271 mm in fork length while the smallest mature female was 277 mm. Overall, 97% of mature least cisco exceeded 274 mm in length (Table 18).

Food habits: The stomachs of 442 least cisco from gillnet catches were examined, of which 210 (48%) were empty or found to contain just a trace of food. Based on a laboratory analysis of 61 stomachs (Table 19), the least cisco diet consisted largely of Crustacea, as Copepoda, Amphipoda, Isopoda, and Mysidacea accounted for 24, 23, 13, and 9%, respectively, of the total food biomass. Insects were relatively important during cycle 1 when they occurred in half of the stomachs examined and contributed 5% of the food biomass. Insect material identified from the stomach contents included larval Chironomidae and Simuliidae, nymphal Ephemeroptera, and adult Diptera, Hymenoptera, Lepidoptera, and Trichoptera. Fish were observed in 11% of the stomachs examined, acounting for just 2% of the total food biomass. Fourhorn sculpin was the only fish species identified from least cisco stomachs.

Fourhorn sculpin

Relative abundance and distribution: Fourhorn sculpin is a highly significant member of the ichthyofauna in coastal areas of the Beaufort Sea, serving as forage for many species. At Phillips Bay it accounted for 9.3% of the total gillnet catch and 29.5% of all fish taken in seines (Table 3). Although contributing

18.0% of the catch at offshore stations, it was most abundant nearshore where 94.2% of gillnetted sculpin were taken. This species was captured at all gillnetting stations except Site 15 (Table 4) and was found at all seining locations (Table 5).

Mean CPUE values at inshore gillnetting sites varied between 3.1 and 5.6 during the first four sampling periods, peaked at 7.6 during cycle 5, then decreased to 1.4 in the final period. The highest individual CPUE values were recorded at Site 2 (23.0 and 18.0 on 10 July and 25 July, respectively), Site 3 (20.0 on 30 July) and Site 4 (15.4 on 29 July).

Most fourhorn sculpin captured in seines were young-of-the-year. The first fry (17 mm) was taken on 6 July at Site 1 and young were common throughout the rest of the study. Young sculpins reached their peak abundance during cycle 4 (22-28 July) when the mean CPUE for all seining locations reached 70.2. While taken at all seining sites, young sculpin seemed to be particularly abundant at Site 66 where 36% of all seined sculpin were taken.

Age and growth: Total lengths for fourhorn sculpin ranged from 12 to 310 mm. Gillnetted fish varied in length from 109 to 310 mm with the majority (78%) falling in the 174-249 mm range (Table 20). Seines captured sculpin between 12 and 243 mm although most of those measured (86%) were less than 25 mm (Table 8). The modal length of young-of-the-year sculpin remained constant (15-19 mm) throughout the sampling period (Table 21). This may reflect very slow growth on the part of this year class. More likely, however, it resulted from a continuous influx of newly hatched fry and emigration of larger individuals from the immediate sampling location.

The weight-length relationships for fourhorn sculpin from Phillips Bay are shown in Table 12. Analysis of covariance indicated a significant difference ($P<0.01$) in adjusted means ($F=59.1161$; $df=297$) but not between the slopes ($F=0.4447$; $df=296$) of the regression lines for male and female fish.

Sex and maturity: Females comprised 66% of all fourhorn sculpin for which sex was determined (n=300), a significant deviation from a 1:1 sex ratio ($X^2=30.72$; $P<0.005$). Among females examined (n=198), 66% were sexually mature. Total lengths recorded for these fish ranged from 149 to 310 mm. Of 102 males examined 43 (42%) were mature (172-263 mm).

Food habits: The stomachs of 271 fourhorn sculpin were examined during the study, of which 80 (30%) were empty or contained just a trace of food. Isopoda dominated the stomach contents. Among stomachs examined in the field that contained some food (n=166), 83% contained isopods. Twenty-five stomachs were examined in more detail in the laboratory (Table 22). Isopoda occurred in all stomachs so examined, comprising 81% of the total food biomass. Mysidacea were not encountered during the laboratory analyses but were recorded in six stomachs examined in the field.

Arctic charr

Although a population of anadromous Arctic charr is known to inhabit the Babbage River (Bain 1974), charr were not common in coastal waters during the present study. This species accounted for 3.1% of the total gillnet catch and just 0.2% of all fish taken in seines (Table 3). A single specimen was captured offshore (Site 14) with the remainder being taken at shoreline sites. The largest gillnet catches were made at Site 4 (n=40) and Site 5 (n=20) to the west of the Spring River. Seventeen charr were taken during cycle 1 but only one was captured between 1 and 21 July. The reappearance of charr on 22 July may have represented the commencement of the return migration to the Babbage. Bain (1974) reported both mature and juvenile fish arriving in the Babbage by early August.

Fork lengths for Arctic charr captured in gillnets ranged from 187 to 635 mm with 79% of all fish falling between 350 and 524 mm (Table 23). Of the nine fish taken in seines, eight ranged in length from 56 to 86 mm (Table 8). According to Bain (1974) charr of this size would be age 1+.

The sex ratio for Arctic charr taken at Phillips Bay in 1985 was heavily in favour of females which comprised 72% of fish for which sex was determined (Table 23). This was a significant departure from 1:1 ($X^2=17.39$; $P<0.005$). The difference in the sex ratio was even more pronounced among mature individuals (n=27), where females comprised 81% of the total. Overall, 19% of males and 33% of females were considered sexually mature. Fork lengths of mature males ranged from 460 to 635 mm while mature females varied from 412 to 565 mm.

GSI values for mature females ranged from 1.16 to 5.43 while egg diameters were between 1.0 and 2.5 mm. Mean values for these two parameters were, respectively, 1.81 and 1.4 mm on 29-30 June (n=5); 3.58 and 2.1 mm on 22-30 July (n=3); and 3.98 and 2.3 mm on 12-21 August.

The combined weight-length regression for Arctic charr captured at Phillips Bay in 1985 (n=104; 187-635 mm) is described by the equation:

$$\log_{10}W = 3.0864 (\log_{10}L) - 5.2935$$

There was no significant difference ($P>0.05$) between the adjusted means ($F=1.0960$; $df=89$) or slopes ($F=0.3829$; $df=88$) of the regressions for males and females (Table 12).

The stomachs of 101 charr were examined during 1985, of which 32 (32%) were either empty or contained just a trace of food. A detailed analysis of 26 stomachs (Table 24) showed fish and Amphipoda to be the dominant food items. Fish occurred in 69% of these stomachs and comprised 47% of the wet weight food biomass. Fish species identified in the food included rainbow smelt, fourhorn sculpin, Arctic cod, least cisco, ninespine stickleback, and Arctic lamprey. Amphipoda appeared in 77% of the stomachs accounting for 29% of the food in terms of wet weight.

Rainbow smelt

Although never captured in large numbers, rainbow smelt were common in the study area, accounting for 4.3% of gillnetted fish and 2.7% of those taken in seines (Table 3). They were the only species captured at all sampling locations, both gillnetting and seining (Tables 4 and 5). The largest individual catches in gillnets occurred on 6 July at Site 21 (n=34), 18 July at Site 6 (n=15), and 29 July at Site 5 (n=12).

Rainbow smelt ranging in fork length from 10 to 313 mm were captured at Phillips Bay in 1985. The size range for smelt captured in gillnets was 124-313 mm although only one fish was smaller than 200 mm and 77% of the total catch fell in the 225-274 mm range (Table 25). Of those taken in seines, 88% were smaller than 50 mm (Table 8).

Young-of-the-year smelt, 10-19 mm long, first appeared in the samples on 23 July when 31 specimens were collected from Site 3 (Mean Length 14.4 mm). Subsequently, small numbers of fry were taken at all locations except Sites 8 and 66. Small smelt (36-68 mm) captured prior to cycle 4 (Table 26) are likely age 1+ and 2+ fish.

Male smelt (55%) outnumbered females in our samples (Table 25) but the sex ratio did not differ significantly from unity (X^2=1.42; P>0.05). Most of the smelt that we examined were mature fish; including 99% of the males (n=73) and 71% of the females (n=58).

The weight-length relationship for male rainbow smelt taken at Phillips Bay in 1985 (n=76; range 209-313 mm) is described by the equation:

$$\log_{10}W = 3.0996\ (\log_{10}L) - 5.3833$$

Analysis of covariance showed the regression for males to differ significantly from that calculated for females (Table 12) both in slope (F=1.7994; df=134; P<0.05) and adjusted means (F=11.5409; df=135; P<0.01).

Rainbow smelt captured in Phillips Bay had been feeding actively as only 15% of all stomachs examined (n=94) were empty. The smelt diet (Table 27) was dominated by fish, which occurred in 87% of the stomachs, comprising 78% of the total food biomass. Arctic cod, although never captured in gillnets or seines, was the primary food item. It was estimated that 49% of the total food biomass (minimum) was Arctic cod. Other fish species identified from the stomach contents included fourhorn sculpin, Arctic cisco, rainbow smelt, and eelpout. Mysidacea occurred in 77% of the stomachs examined in the laboratory and accounted for 18% of the food biomass.

Arctic flounder

Arctic flounder accounted for 5.9% of the total gillnet catch and 1.6% of all fish taken in seines (Table 3). Although captured at all inshore stations they were most common at sites located close to the Babbage River, the largest catches being taken at Sites 2 (n=48) and 6 (n=38). Sites 5 and 9, the sampling locations situated farthest from the Babbage, produced only three and four flounder, respectively. None was captured at Sites 11 and 15, the offshore sites farthest from the river.

Ninety percent of Arctic flounder taken at inshore sites were captured prior to 4 August. Up to that date the mean CPUE for this species was 3.6. After 4 August, however, the comparable figure was 0.8.

Of 79 Arctic flounder taken in seines 50 (63%) were captured prior to 15 July. The largest CPUE values were recorded at Site 7 on 30 June (12.5) and at Site 8 on 30 June (13.9) and 8 August (13.5). Seines took no flounder at Sites 4, 5, or 9.

Total lengths for 276 Arctic flounder ranged from 55 to 282 mm, the majority (84%) being 125 to 224 mm (Tables 8 and 28).

Female Arctic flounder (70%) outnumbered males in our samples (n=178), the sex ratio being significantly different from 1:1 (X^2=29.12; P<0.005). Twenty-five percent of the males and 38% of the females were judged to be sexually mature.

The mathematical relationship between body weight and total length for female Arctic flounder (n=125; range 131-282 mm) is described by the equation:

$$\log_{10}W = 2.9876\ (\log_{10}L) - 4.8890$$

Analysis of covariance indicated a significant difference between adjusted means (F=12.7452; df=175; P<0.01) but not between the slopes (F=0.1160; df=174; P>0.05) of the weight-length regressions for male and female flounder (Table 12).

Other species

Broad whitefish: Only 14 broad whitefish were taken during 1985, all of which were captured in gillnets. Broad whitefish ranged in fork length from 338 to 532 mm (Table 29) and in scale age from 5 to 13 years. Among fish for which sex was determined (n=11), all but two were mature spawners. Mature females (n=5; 440-522 mm; age 8-13) had GSI values between 4.34 and 9.69. For mature males (n=4; 462-532 mm; age 9-13), GSI values varied from 1.24 to 1.79.

Lake whitefish: Fork lengths for lake whitefish captured in gillnets (n=16) ranged from 214 to 438 mm (Table 29). Scale ages for these fish varied from 5 to 17 years but none was considered capable of spawning in the current year. A single lake whitefish (155 mm) was taken in seines, that being captured on 20 July at Site 66.

Inconnu: Twenty inconnu were captured during the 1985 study, 19 in gillnets and one (51 mm) in seines. Those taken in gillnets had fork lengths of 388 to 592 mm (Table 29) and ranged

in scale age from 5 to 14 years. All inconnu observed were non-spawning fish.

Saffron cod: During the present study 22 saffron cod were captured (Table 3), all but one at inshore locations. Saffron cod ranged in length from 334 to 429 mm, the majority (82%) falling in the 350 to 399 mm range (Table 29). Males and females occurred in equal numbers in our sample with 64% being sexually mature in both cases.

Most of the saffron cod examined (95%) had food in their stomachs. Fish occurred in 71% of the stomachs examined, comprising 83% of the total food biomass (Table 30). Fourhorn sculpin was the only fish species identified in the food. Amphipoda occurred in 65% of all stomachs but accounted for only 4% of the food in terms of weight.

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Table 1. Inclusive dates for sampling periods (cycles) referred to in this report, Phillips Bay, 1985.

Period/Cycle	Date
1	29 June to 7 July
2	8 July to 14 July
3	15 July to 21 July
4	22 July to 28 July
5	29 July to 4 August
6	5 August to 11 August
7	12 August to 18 August
8	19 August to 21 August

Table 2. Scientific and common names[1] of fishes captured at Phillips Bay, 1985.

Scientific Name	Common Name	Code
Family Clupeidae		
Clupea harengus pallasi Valenciennes	Pacific herring	PCHR
Family Salmonidae		
Coregonus autumnalis (Pallas)	Arctic cisco	ARCS
Coregonus sardinella Valenciennes	Least cisco	LSCS
Coregonus clupeaformis (Mitchill)	Lake whitefish	LKWT
Coregonus nasus (Pallas)	Broad whitefish	BDWT
Stenodus leucichthys (Guldenstadt)	Inconnu	INCO
Salvelinus alpinus (Linnaeus)	Arctic charr	CHAR
Thymallus arcticus (Pallas)	Arctic grayling	ARGR
Family Osmeridae		
Osmerus mordax (Mitchill)	Rainbow smelt	RNSM
Family Gadidae		
Eleginus gracilis (Tilesius)	Saffron cod,	SFCD
Family Gasterosteidae		
Pungitius pungitius (Linnaeus)	Ninespine stickleback	NSSB
Family Ammodytidae		
Ammodytes hexapterus Pallas	Pacific sand lance	PCSN
Family Cottidae		
Myoxocephalus quadricornis (Linnaeus)	Fourhorn sculpin	FHSC
Family Pleuronectidae		
Liopsetta glacialis (Pallas)	Arctic flounder	ARFL

[1] From Robins et al. (1980).

Table 3. Total number (N) and percentage composition (%) for fish captured in gillnets and seines at Phillips Bay, 1985.

Species	Gillnets						Seines		Grand Total	
	Inshore[1]		Offshore		Total					
	N	%	N	%	N	%	N	%	N	%
Arctic cisco	1741	53.4	38	38.0	1779	53.0	2933	60.7	4712	57.5
Least cisco	743	22.8	6	6.0	749	22.3	247	5.1	996	12.2
Fourhorn sculpin	295	9.1	18	18.0	313	9.3	1425	29.5	1738	21.2
Arctic flounder	189	5.8	9	9.0	198	5.9	79	1.6	277	3.4
Rainbow smelt	119	3.7	26	26.0	145	4.3	132	2.7	277	3.4
Arctic charr	103	3.2	1	1.0	104	3.1	9	0.2	113	1.4
Saffron cod	21	0.6	1	1.0	22	0.7			22	0.3
Inconnu	19	0.6			19	0.6	1	<0.1	20	0.2
Broad whitefish	14	0.4			14	0.4			14	0.2
Lake whitefish	16	0.5			16	0.5	1	<0.1	17	0.2
Pacific herring			1	1.0	1	<0.1			1	<0.1
Ninespine stickleback							2	<0.1	2	<0.1
Arctic grayling							1	<0.1	1	<0.1
Pacific sand lance							1	<0.1	1	<0.1
Unidentified							4	0.1	4	<0.1
Total	3260		100		3360		4835		8195	

[1] Includes 37 fish captured at Site 1 on 27 June and 21 fish captured 18 August inside the mouth of the Spring River. (These fish are not included in subsequent analyses.)

Table 4. Total gillnet catch by sampling location, Phillips Bay, 1985.

Species	Number of fish captured at each location														Total	
	1	2	3	4	5	6	7	9	21	11	12	13	14	15	N	%
Arctic cisco	157	196	258	242	309	224	129	134	60	4		18	9	7	1747	52.9
Least cisco	105	80	120	92	44	142	85	37	31	1	1	1	3		742	22.5
Arctic charr	4	12	13	40	20	2	3	6	0	0			1		101	3.1
Arctic flounder	17	48	21	22	3	38	12	4	19	0	1	4	4		193	5.8
Fourhorn sculpin	29	68	35	35	22	25	36	12	28	1	4	10	3		308	9.3
Rainbow smelt	5	3	6	4	14	20	27	4	36	3	6	11	3	3	145	4.4
Broad whitefish	1	2	0	4	0	3	0	2	1	0					13	0.4
Lake whitefish	1	3	1	1	0	6	0	1	0	0					13	0.4
Inconnu	1	4	2	2	0	1	0	0	7	0					17	0.5
Saffron cod	3	3	3	2	3	3	1	0	3	0		1			22	0.7
Pacific herring	0	0	0	0	0	0	0	0	0	0			1		1	<0.1
Total	323	419	459	444	415	464	293	200	185	9	12	45	24	10	3302	
Minutes of Effort	555	540	530	490	405	420	480	420	555	865	2095	940	1040	950	10285	

Table 5. Total seine catch by sampling location, Phillips Bay, 1985

Species	Number of fish captured at each location											Total	
	1	2	3	4	5	6	66	7	8	9	10	N	%
Arctic cisco	1394	217	236	128	88	24	445	100	62	38	201	2933	60.7
Least cisco	95	23	25	12	11	7	2	9	6	16	41	247	5.1
Fourhorn sculpin	58	109	139	42	122	20	511	192	79	94	60	1425	29.5
Arctic flounder	17	16	3			3	8	8	21		3	79	1.6
Rainbow smelt	11	17	37	11	17	2	1	6	16	1	13	132	2.7
Arctic charr	1	1		1					5		1	9	0.2
Inconnu		1										1	<0.1
Lake whitefish							1					1	<0.1
Ninespine stickleback	1				1							2	<0.1
Arctic grayling									1			1	<0.1
Pacific sand lance					1							1	<0.1
Unidentified							3				1	4	0.1
Total	1577	384	440	194	240	56	971	315	190	149	320	4835	
Effort (metres of shoreline seined)	758	806	703	677	617	416	403	757	635	613	671	7056	

Table 6. Range of water temperature and salinity at which the major fish species were captured at Phillips Bay, 1985.

Species	Water Temperature (°C)	Salinity (‰)
Arctic cisco	0.9 to 13.2	0.0 to 28.2
Least cisco	1.6 to 13.2	0.0 to 28.2
Fourhorn sculpin	-0.7 to 13.2	0.0 to 28.9
Arctic flounder	1.0 to 13.2	0.0 to 22.9
Rainbow smelt	-0.7 to 11.5	0.0 to 28.9
Arctic charr	2.0 to 12.5	0.8 to 26.5
Broad whitefish	5.6 to 12.0	1.4 to 22.9
Lake whitefish	2.0 to 11.0	1.0 to 22.9
Inconnu	2.0 to 12.0	1.0 to 15.3
Saffron cod	4.0 to 11.5	0.0 to 11.8

Table 7. Length-frequency distribution for Arctic cisco captured in gillnets at Phillips Bay, 1985.

Fork Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
150-174	2	0.1	1	0.1	1	0.1	4	0.2
175-199	3	0.2	6	0.3	6	0.3	15	0.8
200-224	3	0.2	12	0.7	5	0.3	20	1.1
225-249	15	0.8	14	0.8	4	0.2	33	1.9
250-274	16	0.9	17	1.0	3	0.2	36	2.0
275-299	55	3.1	40	2.3	5	0.3	100	5.6
300-324	95	5.3	64	3.6	9	0.5	168	9.4
325-349	253	14.2	79	4.4	4	0.2	336	18.9
350-374	417	23.4	193	10.9	7	0.4	617	34.7
375-399	169	9.5	175	9.8	1	0.1	345	19.4
400-424	37	2.1	49	2.8			86	4.8
425-449	2	0.1	16	0.9			18	1.0
450-474			1	0.1			1	0.1
Total	1067		667		45		1779	

[1] Percentage of Total N.

Table 8. Length-frequency distributions for fish captured in seines at Phillips Bay, 1985.

Fork Length (mm)	ARCS		LSCS		FHSC		ARFL		RNSM		CHAR		LKWT		INCO		NSSR		ARGR		PCSN	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
0-24	22	1.4																				
25-49	1303	83.9	112	51.6	691	85.5			57	44.2							1	50.0				
50-74	197	12.7	72	33.2	38	4.7			56	43.4							1	50.0				
75-99	4	0.3	6	2.8	51	6.3	5	6.3	15	11.6	7	77.8			1	100.0					1	100.0
100-124	3	0.2	4	1.8	12	1.5	3	3.8	1	0.8	1	11.1										
125-149			2	0.9	3	0.4																
150-174			4	1.8	3	0.4	9	11.4											1	100.0		
175-199					3	0.4	26	32.9					1	100.0								
200-224	1	0.1			4	0.5	19	24.1														
225-249	1	0.1					11	13.9														
250-274			3	1.4	3	0.4	2	2.5														
275-299	1	0.1	7	3.2			3	3.8														
300-324	2	0.1	3	1.4			1	1.3														
325-349	4	0.3	4	1.8																		
350-374	5	0.3																				
375-399	8	0.5																				
400-424	1	0.1																				
425-449	1	0.1																				
450-474																						
475-499											1	11.1										
Total	1553		217		808		79		129		9		1		1		2		1		1	

Table 9. Mean fork length (mm), mean weight (g), mean condition factor (K), sex ratio, and maturity by age group for Arctic cisco captured at Phillips Bay, 1985.

Scale Age (yr)	Number of Fish	Fork Length			Weight			Mean Condition Factor (K)	Males		Females		Number Sex Unknown
		Mean	SD	Range	Mean	SD	Range		n	% Mature	n	% Mature	
0	194[1]	34	6.5	19-52									194
1	6	96	11.4	82-113	6	2.5	3-10	0.66					6
2	2	144	40.3	115-172	28	22.6	12-44	0.94					2
3	35	198	16.4	169-241	68	18.9	43-124	0.87	7	0	17	0	11
4	31	239	14.7	208-273	124	25.8	73-201	0.90	17	0	13	0	1
5	51	273	22.3	241-351	192	58.3	122-443	0.95	22	0	26	0	3
6	59	317	24.6	280-388	319	88.7	190-575	1.00	36	3	22	0	1
7	55	367	25.5	314-420	517	118.9	289-808	1.05	31	6	24	29	
8	23	386	18.4	346-408	588	107.1	353-743	1.02	12	8	11	55	
9	14	408	20.0	379-442	666	125.3	459-906	0.98	8	0	6	0	
10	13	425	19.3	390-460	763	158.7	513-972	0.99	1	0	12	25	
11	9	433	13.0	405-447	825	86.0	690-946	1.02			9	44	
12	2	395	13.4	385-404	657	179.6	530-784	1.07			2	50	
Total	494								134		142		218

[1] Captured 12-13 July.

Table 10. Length-frequency distribution by age group for Arctic cisco captured at Phillips Bay, 1985.

Fork Length (mm)	Scale Age (yr)												Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	
0-24	11													11
25-49	179													179
50-74	4													4
75-99		4												4
100-124		2	1											3
125-149														0
150-174			1	3										4
175-199				15										15
200-224				16	3									19
225-249				1	22	7								30
250-274					6	23								29
275-299						16	14							30
300-324						3	23	4						30
325-349						1	19	9	1					30
350-374						1	1	22	5					29
375-399							2	13	8	5	1		1	30
400-424								7	9	6	5	1	1	29
425-449										3	6	8		17
450-474											1			1
Total	194	6	2	35	31	51	59	55	23	14	13	9	2	494

Table 11. Length-frequency distribution for small Arctic cisco by sampling period, Phillips Bay, 1985.

Fork Length (mm)	Number by Sampling Period								Total	
	1	2	3	4	5	6	7	8	N	%
15-19		1							1	0.1
20-24		10	3	7	1				21	1.4
25-29		42	6	63	15	1	2		129	8.4
30-34		57	2	95	97	34	7	1	282	18.4
35-39		51		51	127	90	19	11	349	22.8
40-44		17	2	13	57	127	78	29	323	21.1
45-49		12		4	13	91	64	36	220	14.4
50-54		4		1	12	31	73	8	129	8.4
55-59				1	5	9	26	8	49	3.2
60-64						3	10		13	0.9
65-69						1	4		5	0.3
70-74							1		1	0.1
75-79										
80-84					1				1	0.1
85-89					1				1	0.1
90-94					1				1	0.1
95-99				1					1	0.1
100-104								1	1	0.1
105-109										
110-114		1							1	0.1
115-119	1								1	0.1
120-124										
Total	1	195	13	236	319	387	284	94	1529	

Table 12. Weight-length relationships for the major fish species captured at Phillips Bay, 1985.

Species	Sex	Number of Fish	Range in Fork Length (mm)	Slope (b)	Intercept (a)	SD_b
Arctic cisco	Male	134	169-440	3.2296	-5.5903	0.0318
	Female	142	174-460	3.2242	-5.5773	0.0399
	Combined	293	169-460	3.2383	-5.6128	0.0238
Least cisco	Male	70	182-326	3.3943	-6.0303	0.0698
	Female	120	187-343	3.4038	-6.0591	0.0502
	Combined	199	171-343	3.3836	-6.0081	0.0364
Fourhorn sculpin	Male	102	126-281	3.2876	-5.7536[1]	0.0748
	Female	198	109-310	3.2047	-5.4992	0.0751
Rainbow smelt	Male	76	209-313	3.0996[1]	-5.3833[1]	0.1482
	Female	62	213-293	2.7542	-4.5816	0.2216
Arctic flounder	Male	53	97-232	3.0184	-4.9821[1]	0.0698
	Female	125	131-282	2.9876	-4.8890	0.0459
Arctic charr	Male	26	357-635	3.1521	-5.4738	0.1507
	Female	66	187-576	3.0663	-5.2349	0.0540
	Combined	104	187-635	3.0864	-5.2935	0.0458

[1] Indicates significant difference between male and female fish.

Table 13. Length-frequency distribution according to maturity stage for Arctic cisco taken in gillnets at Phillips Bay, 1985.

Fork Length (mm)	Number of Fish							
	Males				Females			
	Immature	Maturing	Mature	Total	Immature	Maturing	Mature	Total
150-174	2			2	1			1
175-199	3			3	6			6
200-224	3			3	12			12
225-249	15			15	14			14
250-274	15			15	17			17
275-299	53			53	38			38
300-324	77	9		86	50	5	1	56
325-349	78	130	15	223	39	31	1	71
350-374	38	320	35	393	17	126	31	174
375-399	6	142	17	165	4	115	50	169
400-424	1	31	4	36	1	31	13	45
425-449		2		2		11	5	16
450-474						1		1
Total	291	634	71	996	199	320	101	620
Percentage	29	64	7		32	52	16	

Table 14. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of Arctic cisco by sampling period, Phillips Bay, 1985.

Food Item	Sampling Period														Total	
	1		2		3		4		5		6		7		8		FO	Wt
	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt		
Amphipoda	100	5	77	43	100	43	14	9	67	25	100	64	80	24	100	52	80	30
Mysidacea	78	76	53	7	50	32	43	32	83	33	86	9	100	57	100	18	72	30
Isopoda	44	4	88	20	38	1	0	0	0	0	0	0	0	0	0	0	31	4
Copepoda	11	<1	53	6	63	4	86	41	67	12	100	12	100	11	100	20	69	14
Cumacea	0	0	6	<1	0	0	0	0	0	0	0	0	0	0	0	0	1	<1
Insecta	0	0	6	<1	0	0	0	0	0	0	0	0	0	0	0	0	1	<1
Pelecypoda	0	0	12	<1	13	<1	0	0	0	0	0	0	0	0	0	0	4	<1
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0	20	<1	29	<1	6	<1
Polychaeta	11	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	<1
Fish	22	<1	2	2	38	5	29	12	67	7	57	9	60	2	43	<1	39	4
Residue	100	10	100	13	100	16	100	6	100	22	100	5	100	5	100	10	100	8
No. stomachs analyzed	9		17		8		7		6		7		10		7		71	
Total wet weight of stomach contents (g)	12.23		41.79		15.92		20.02		9.28		62.62		86.64		56.39		304.89	

Table 15. Length-frequency distribution for least cisco captured in gillnets at Phillips Bay, 1985.

Fork Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
150-174	2	0.3			1	0.1	3	0.4
175-199	9	1.2	19	2.5	12	1.6	40	5.3
200-224	16	2.1	23	3.1	3	0.4	42	5.6
225-249	18	2.4	13	1.7			31	4.1
250-274	54	7.2	29	3.9	3	0.4	86	11.5
275-299	105	14.0	146	19.5	10	1.3	261	34.9
300-324	29	3.9	202	27.0	5	0.7	236	31.5
325-349	1	0.1	46	6.1	1	0.1	48	6.4
350-374			2	0.3			2	0.3
Total	234		480		35		749	

[1] Percentage of Total N.

Table 16. Mean fork length (mm), mean weight (g), mean condition factor (K), sex ratio, and maturity by age group for least cisco captured at Phillips Bay, 1985.

Scale Age (yr)	Number of Fish	Fork Length			Weight			Mean Condition Factor (K)	Males		Females		Number Sex Unknown
		Mean	SD	Range	Mean	SD	Range		n	% Mature	n	% Mature	
0	182	47	7.7	25-68	0.8	0.4	0.1-2	0.72					182
1	6	87	14.9	68-110	5	2.5	2-9	0.73					6
2	4	146	38.4	105-193	27	18.0	10-50	0.88			1	0	3
3	23	189	9.8	171-211	51	8.4	38-75	0.75	6	0	9	0	8
4	29	212	9.7	198-227	72	12.7	56-110	0.76	13	0	15	0	1
5	23	239	9.5	223-255	111	16.2	78-138	0.81	12	0	11	0	
6	17	256	11.6	233-273	138	28.0	99-199	0.83	8	0	9	0	
7	40	281	15.1	254-310	195	39.5	133-292	0.88	20	10	20	20	
8	37	305	11.6	283-330	251	45.6	174-394	0.88	8	13	29	21	
9	16	325	13.4	285-352	315	58.8	214-421	0.92	3	67	13	38	
10	12	332	4.8	327-343	339	54.4	284-488	0.93			12	25	
11	1	343			384			0.95			1	0	
Total	390								70		120		200

Table 17. Length-frequency distribution by age group for least cisco captured at Phillips Bay, 1985.

Fork Length (mm)	Scale Age (yr)											Total
	0	1	2	3	4	5	6	7	8	9	10	11	
0-24													
25-49	112												112
50-74	70	1											71
75-99		4											4
100-124		1	1										2
125-149			1										1
150-174			1	1									2
175-199			1	18	2								21
200-224				4	23	2							29
225-249					4	18	8						30
250-274						3	9	16					28
275-299								17	13				30
300-324								7	22	3			32
325-349									2	12	12	1	27
350-374										1			1
Total	182	6	4	23	29	23	17	40	37	16	12	1	390

Table 18. Length-frequency distribution according to maturity stage for least cisco taken by gillnets at Phillips Bay, 1985.

Fork Length (mm)	Number of Fish							
	Males				Females			
	Immature	Maturing	Mature	Total	Immature	Maturing	Mature	Total
150-174	2			2				
175-199	9			9	19			19
200-224	16			16	23			23
225-249	14	4		18	11	2		13
250-274	13	37	3	53	10	19		29
275-299	13	73	12	98	14	84	24	122
300-324	3	15	8	26	7	105	41	153
325-349			1	1		28	8	36
350-374							1	1
Total	70	129	24	223	84	238	74	396
Percentage	31	58	11		21	60	19	

Table 19. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of least cisco by sampling period, Phillips Bay, 1985.

Food Item	Sampling Period 1		2		3		4		5		6		7		8		Total	
	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt
Amphipoda	100	60	70	7	83	29	50	<1	100	8	70	19	67	<1	100	12	80	23
Mysidacea	30	<1	30	3	42	1	0	0	67	48	40	12	33	1	100	5	39	6
Isopoda	80	9	40	15	83	36	0	0	56	14	20	<1	33	<1	0	0	49	11
Copepoda	0	0	20	19	25	11	67	37	78	9	90	53	100	42	100	58	48	24
Insecta	50	5	30	<1	58	<1	0	0	33	1	0	0	0	0	0	0	29	1
Polychaeta	10	<1	0	0	17	<1	0	0	0	0	0	0	0	0	0	0	5	<1
Fish	0	0	10	9	8	<1	17	7	22	1	0	0	67	2	0	0	11	3
Residue	100	26	100	46	100	24	100	55	100	19	100	16	100	55	100	28	100	29
No. stomachs analyzed	10		10		12		6		9		10		3		1		61	
Total wet weight of stomach contents (g)	8.64		6.64		10.56		3.59		6.25		11.16		2.97		0.97		50.78	

Table 20. Length-frequency distribution for fourhorn sculpin captured in gillnets at Phillips Bay, 1985.

Total Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
100-124			1	0.3			1	0.3
125-149	5	1.6	8	2.6	2	0.7	15	4.9
150-174	13	4.2	21	6.8	3	1.0	37	12.0
175-199	33	10.7	42	13.6	1	0.3	76	24.6
200-224	30	9.7	62	20.1	1	0.3	93	30.1
225-249	17	5.5	45	14.6	2	0.7	64	20.7
250-274	3	1.0	11	3.6			14	4.5
275-299	1	0.3	7	2.3			8	2.6
300-324			1	0.3			1	0.3
Total	102		198		9		309	

[1] Percentage of Total N.

Table 21. Length-frequency distribution for small fourhorn sculpin by sampling period, Phillips Bay, 1985.

Total Length (mm)	Number by Sampling Period 1	2	3	4	5	6	7	8	Total N	Total %
10-14		12	4	5			3	1	25	3.2
15-19	1	89	37	196	59	59	49	45	535	67.6
20-24		1	4	11	25	54	4	32	131	16.5
25-29			1	6	1	1		3	12	1.5
30-34				5	2	2			9	1.1
35-39				1	1	3		1	6	0.8
40-44		1	2					1	4	0.5
45-49	1		1	3			1	1	7	0.9
50-54	2	2	3	1	2				10	1.3
55-59	4			2	4				10	1.3
60-64			1	1	6	2			10	1.3
65-69	3	1	1	3	3	1			13	1.6
70-74	4			1	1	2			8	1.0
75-79	1		1	2					4	0.5
80-84	3		1						4	0.5
85-89			1						1	0.1
90-94	1		1						2	0.3
95-99			1						1	0.1
Total	20	106	59	237	104	124	57	85	792	

Table 22. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of fourhorn sculpin by sampling period, Phillips Bay, 1985.

Food Item	Sampling Period 1		2		3		4		5		6		Total	
	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt
Amphipoda	50	<1	43	<1	71	1	0	0	100	10	50	1	52	<1
Isopoda	100	90	100	86	100	88	100	54	100	84	100	70	100	81
Fish	0	0	0	0	0	0	0	0	0	0	50	20	4	2
Plant Material	33	<1	43	<1	86	<1	100	4	0	0	50	2	56	1
Residue	100	10	100	14	100	11	100	42	100	6	100	7	100	16
No. stomachs analyzed	6		7		7		4		1		2		25	
Total wet weight of stomach contents (g)	32.19		80.35		13.72		20.96		1.56		20.83		169.61	

Table 23. Length-frequency distribution for Arctic charr captured in gillnets at Phillips Bay, 1985.

Fork Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
175-199			3	2.9	1	1.0	4	3.8
200-224								
225-249					1	1.0	1	1.0
250-274								
275-299			1	1.0			1	1.0
300-324			1	1.0	1	1.0	2	1.9
325-349			2	1.9	1	1.0	3	2.9
350-374	4	3.8	7	6.7	2	1.9	13	12.5
375-399	6	5.8	6	5.8	5	4.8	17	16.3
400-424	3	2.9	9	8.7			12	11.5
425-449	1	1.0	7	6.7	1	1.0	9	8.7
450-474	2	1.9	7	6.7			9	8.7
475-499	3	2.9	8	7.7			11	10.6
500-524	3	2.9	8	7.7			11	10.6
525-549			5	4.8			5	4.8
550-574	1	1.0	1	1.0			2	1.9
575-599	1	1.0	1	1.0			2	1.9
600-624	1	1.0					1	1.0
625-649	1	1.0					1	1.0
Total	26		66		12		104	

[1] Percentage of Total N.

Table 24. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of Arctic charr by sampling period, Phillips Bay, 1985.

Food Item	Sampling Period 1		4		5		6		7		8		Total	
	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt
Amphipoda	100	59	50	1	25	<1	100	8	100	41	100	39	77	29
Mysidacea			50	3			100	15	100	1	100	5	62	4
Isopoda	67	13					100	65					15	6
Copepoda							50	<1	100	<1	78	2	39	1
Insecta	67	<1											8	<1
Pelecypoda	33	1											4	<1
Gastropoda											11	1	4	1
Fish			100	92	100	97			100	48	67	38	69	47
Plant Material	33	<1											4	<1
Residue	100	27	83	5	100	3	100	12	100	10	100	15	96	12
No. stomachs analyzed	3		6		4		2		2		9		26	
Total wet weight of stomach contents (g)	7.37		32.00		27.97		22.57		30.91		157.17		277.99	

Table 25. Length-frequency distribution for rainbow smelt captured in gillnets at Phillips Bay, 1985.

Fork Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
100-124					1	0.7	1	0.7
125-149								
150-174								
175-199								
200-224	3	2.1	8	5.6			11	7.7
225-249	19	13.4	18	12.7			37	26.1
250-274	42	29.6	30	21.1	1	0.7	73	51.4
275-299	9	6.3	6	4.2	2	1.4	17	12.0
300-324	3	2.1					3	2.1
Total	76		62		12		142	

[1] Percentage of Total N.

Table 26. Length-frequency distribution for small rainbow smelt by sampling period, at Phillips Bay, 1985.

Fork Length (mm)	Number by Sampling Period								Total	
	1	2	3	4	5	6	7	8	N	%
10-14				15					15	11.6
15-19				18	9	2	1		30	23.3
20-24				3	4	5			12	9.3
25-29				2	1	14		2	19	14.7
30-34				4		2			6	4.7
35-39	4	5		8		2			19	14.7
40-44	3	2		1	1		1		8	6.2
45-49	1			3					4	3.1
50-54	2								2	1.6
55-59	2	3							5	3.9
60-64	3	1							4	3.1
65-69	2				1			1	4	3.1
70-74										
75-79					1				1	0.8
80-84										
Total	17	11	0	54	17	25	2	3	129	

Table 27. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of rainbow smelt by sampling period, Phillips Bay, 1985.

Food Item	Sampling Period										Total	
	1		3		4		5		6			
	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt	FO	Wt
Amphipoda	100	10	86	1	20	1	71	<1	60	1	67	1
Mysidacea	33	28	100	26	80	6	71	8	100	53	77	18
Isopoda	50	10	0	0	0	0	0	0	0	0	10	<1
Copepoda	33	<1	57	<1	20	<1	43	<1	40	<1	40	<1
Fish	33	24	100	69	100	92	100	89	100	45	87	78
Residue	100	28	86	5	100	1	71	3	80	1	87	4
No. stomachs analyzed	6		7		5		7		5		30	
Total wet weight of stomach contents (g)	6.14		73.69		42.94		91.85		20.41		235.03	

Table 28. Length-frequency distribution for Arctic flounder captured in gillnets at Phillips Bay, 1985.

Total Length (mm)	Males		Females		Sex Unknown		Total	
	N	%[1]	N	%	N	%	N	%
75-99	1	0.5					1	0.5
100-124	1	0.5					1	0.5
125-149	11	5.6	10	5.1	8	4.1	29	14.7
150-174	26	13.2	24	12.2	5	2.5	55	27.9
175-199	9	4.6	25	12.7	4	2.0	38	19.3
200-224	4	2.0	38	19.3	2	1.0	44	22.3
225-249	1	0.5	16	8.1			17	8.6
250-274			9	4.6			9	4.6
275-299			3	1.5			3	1.5
300-324								
Total	53		125		19		197	

[1] Percentage of Total N.

Table 29. Length-frequency distribution for broad whitefish, lake whitefish, inconnu, and saffron cod captured in gillnets at Phillips Bay, 1985.

Fork Length (mm)	BDWT		LKWT		INCO		SFCO	
	N	%	N	%	N	%	N	%
200-224			1	.3				
225-249			3	18.8				
250-274			2	12.5				
275-299			1	6.3				
300-324			1	6.3				
325-349	1	7.1	3	18.8			2	9.1
350-374			1	6.3			8	36.4
375-399	4	28.6	1	6.3	2	10.5	10	45.5
400-424			2	12.5			1	4.6
425-449	1	7.1	1	6.3	5	26.3	1	4.6
450-474	1	7.1			2	10.5		
475-499	3	21.4			3	15.8		
500-524	3	21.4			3	15.8		
525-549	1	7.1			1	5.3		
550-574					1	5.3		
575-599					2	10.5		
Total	14		16		19		22	

Table 30. Percentage frequency of occurrence (FO) and percentage wet weight (Wt) for major components of the diet of saffron cod, Phillips Bay, 1985.

Food Item	FO	Wt
Amphipoda	65	4
Mysidacea	47	1
Isopoda	47	1
Fish	71	83
Residue	100	10
No. stomachs analyzed	17	
Total wet weight of stomach contents (g)	91.46	

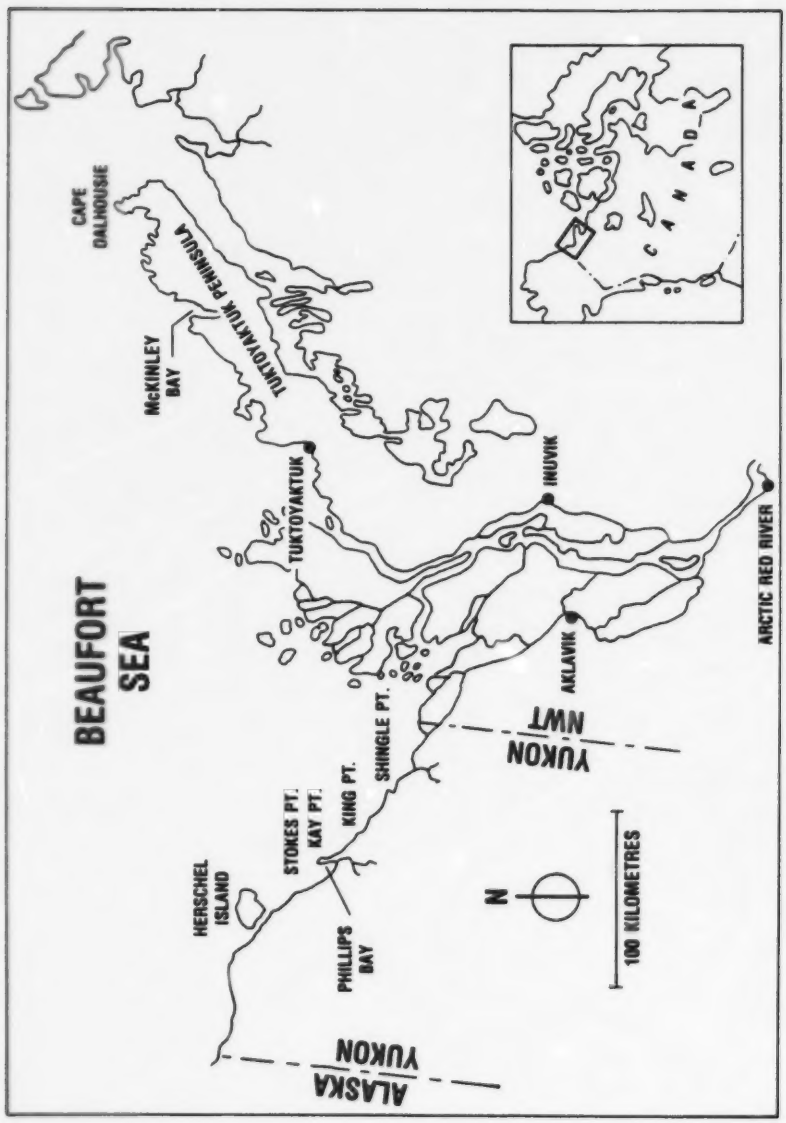

Fig. 1. The Mackenzie Delta and southern Beaufort Sea showing the location of the study area.

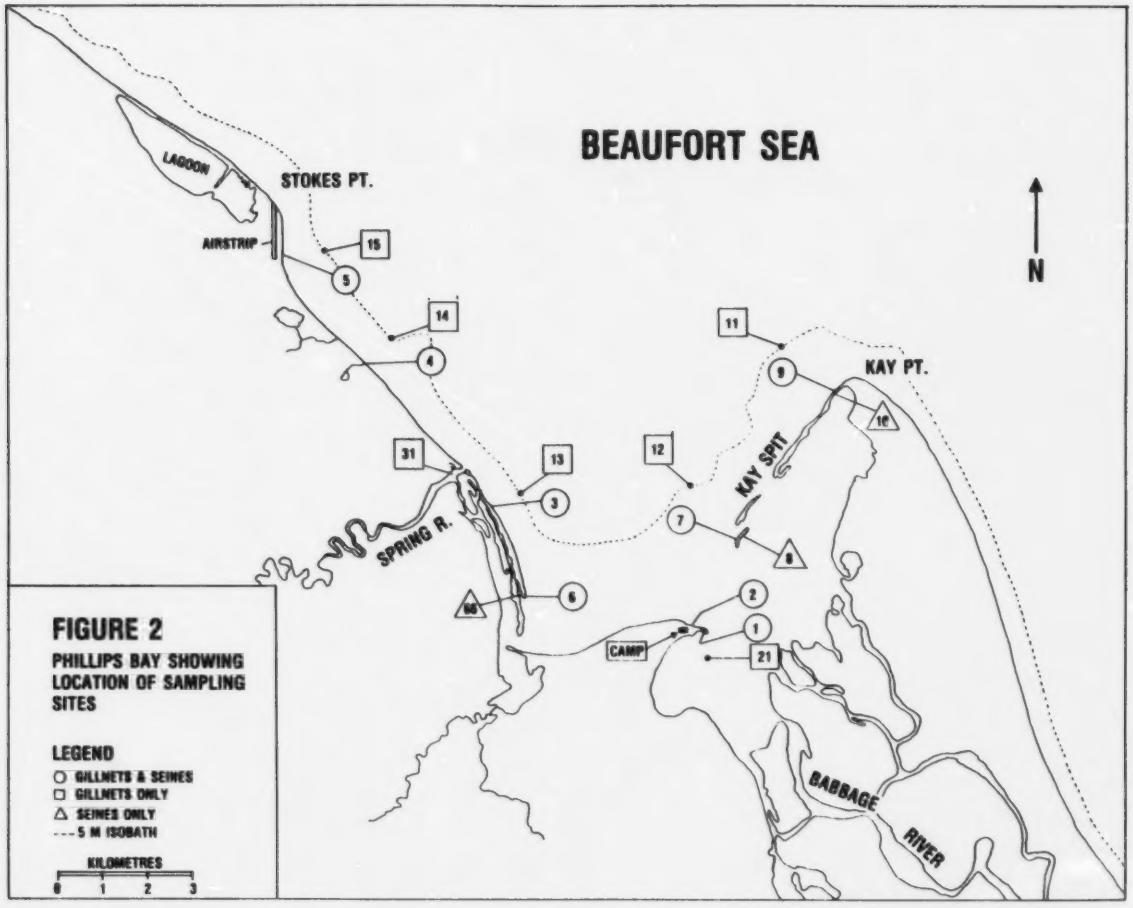

Fig. 2. Phillips Bay showing location of sampling sites.

Table A1. Water temperature, salinity, and conductivity recorded at each sampling location, Phillips Bay, 1985.[1]

Date	Water Temp. (°C)	Salinity (‰)	Conductivity (µS·cm⁻¹)
PB001			
29 June	12.5	0.8	1 200
6 July	10.0	0.0	229
11 "	11.5	1.9	2 590
13 "	9.5	0.8	1 110
16 "	10.0	2.0	2 590
17 "	9.5	2.6	3 540
25 "	9.5	2.8	4 000
26 "	11.0	3.1	4 200
29 "	9.5	3.0	3 500
4 August	9.1	4.5	5 700
10 "	9.0	15.0	16 500
17 "	8.0	6.9	8 200
21 "	5.8	7.2	9 900
PB002			
29 June	9.0	1.2	1 650
3 July	12.5	0.5	1 000
8 "	9.0	0.2	415
10 "	9.8	3.9	5 400
16 "	9.5	3.1	3 310
20 "	6.5	2.0	2 270
25 "	9.5	3.3	4 500
26 "	10.5	3.2	4 100
3 August	13.2	3.3	4 230
10 "	7.0	22.9	23 900
15 "	2.0	26.5	33 900
21 "	3.8	23.9	29 600
PB003			
29 June	3.0	1.0	1 350
2 July	5.9	0.8	1 400
12 "	7.2	2.4	2 940
15 "	5.0	3.5	3 890
23 "	6.0	4.2	5 300
30 "	7.5	2.3	2 750
9 August	9.4	9.1	13 500
15 "	1.7	26.2	33 400
17 "	6.0	10.6	12 000
19 "	6.5	15.3	20 000
PB004			
29 June	2.0	1.0	1 350
3 July	4.5	1.0	1 780
18 "	5.0	3.7	4 610
21 "	6.0	4.4	4 690
22 "	7.0	4.6	7 000
29 "	7.0	3.0	3 370
9 August	5.6	17.0	20 400
12 "	7.1	5.5	6 800
13 "	7.0	8.7	11 400
19 "	4.8	19.0	23 100
PB005			
9 July	0.9	3.6	4 320
15 "	3.7	4.5	4 650
22 "	5.5	5.1	7 600
29 "	7.5	2.4	2 850
5 August	6.3	5.0	6 200
9 "	5.0	17.0	20 300
12 "	7.0	5.8	6 500
13 "	7.5	8.3	11 100
19 "	4.5	17.2	24 200
PB006			
3 July	13.0	ND	ND
10 "	6.9	4.7	5 100
18 "	6.0	3.2	4 180
23 "	8.0	2.8	3 600
26 "	7.5	3.6	3 300
3 August	8.5	6.6	8 800
9 "	6.7	16.5	19 900
13 "	6.8	11.8	12 400
19 "	7.0	14.8	18 200
PB066			
3 July	10.0	1.0	1 770
20 "	5.0	4.5	5 400
26 "	10.0	3.3	4 590
3 August	9.7	6.3	8 700
9 "	6.6	17.1	20 800
13 "	7.2	10.3	12 300
19 "	7.0	15.6	19 100
PB007			
30 June	9.0	1.0	1 450
8 July	4.0	4.2	5 500
12 "	7.0	3.0	4 620
18 "	8.5	3.0	3 790
21 "	8.0	3.5	3 510
24 "	6.5	4.0	5 200
30 "	9.5	3.8	5 550
8 August	1.8	28.2	38 000
14 "	5.5	14.7	19 200
20 "	7.0	17.8	21 800
PB008			
12 July	7.0	5.4	7 400
16 "	5.0	4.4	4 740
25 "	10.0	3.9	5 600
30 "	11.5	2.8	3 910
8 August	9.7	17.3	23 500
14 "	9.0	8.1	10 300
20 "	9.0	8.5	10 900
PB009			
2 July	4.2	0.8	1 400
8 "	1.0	2.8	3 400
12 "	7.0	2.0	2 850
16 "	4.0	3.5	3 850
24 "	6.0	3.7	4 590
30 "	9.5	3.6	4 830
8 August	3.0	26.8	35 000
14 "	6.0	11.6	14 300
20 "	5.3	13.5	16 900
PB010			
4 July	11.1	1.3	2 350
12 "	6.8	6.0	8 500
16 "	4.0	4.2	4 510
25 "	6.0	4.0	5 400
30 "	9.5	4.0	5 700
8 August	9.0	10.4	15 700
14 "	6.0	12.4	15 300
20 "	6.0	9.4	11 900
PB021			
6 July	10.0	0.0	229
11 "	12.0	2.7	3 300
17 "	9.0	2.7	3 310
25 "	10.5	2.4	3 390
29 "	10.0	2.4	2 500
10 August	10.0	15.3	16 400
17 "	6.0	3.4	3 870
21 "	6.2	4.8	6 500
PB011			
2 July S	4.8	1.0	1 440
B	3.4	4.8	5 200
8 July S	1.5	2.0	2 550
B	1.0	9.4	10 900
16 July S	5.0	3.5	4 250
B	4.0	3.6	4 420
24 July S	5.5	3.5	4 360
B	4.5	4.2	5 800
30 July S	8.0	3.3	4 600
B	4.3	7.0	9 800
8 Aug. S	3.3	26.0	34 400
B	-0.5	29.9	38 700
14 Aug. S	6.5	11.2	14 300
B	1.0	26.8	31 400
20 Aug. S	5.0	14.1	17 300
B	2.1	24.0	28 200
PB012			
2 July S	4.5	0.9	1 460
B	2.0	8.7	9 800
8 July S	2.0	5.3	6 900
B	1.0	7.4	10 300
18 July S	8.2	3.3	4 100
B	6.0	3.3	4 210
24 July S	6.0	3.9	5 100
B	4.5	4.3	6 100
30 July S	8.5	3.4	4 800
B	3.8	7.3	9 900
7 Aug. S	1.6	24.2	28 100
B	-0.7	28.9	32 200
14 Aug. S	6.0	12.4	15 200
B	1.2	27.6	31 600
20 Aug. S	5.0	17.1	20 600
B	3.0	22.1	26 100
PB013			
2 July S	3.5	0.9	1 330
B	2.5	4.3	5 100
12 July S	9.0	1.6	1 850
B	3.0	11.1	13 200
15 July S	5.0	4.0	4 280
B	4.1	5.1	5 500
23 July S	6.5	3.7	4 680
B	5.5	4.7	5 900
29 July S	7.5	3.4	3 820
B	5.0	5.1	5 800
9 Aug. S	6.0	14.9	18 200
B	2.0	24.9	29 100
13 Aug. S	6.2	10.4	12 300
B	4.8	20.0	20 500
19 Aug. S	5.5	15.0	18 300
B	3.1	22.6	27 400
PB014			
3 July S	3.0	1.1	2 030
B	1.6	9.0	12 800
9 July S	3.5	3.9	4 490
B	0.8	6.9	7 600
18 July S	5.0	3.3	4 050
B	4.5	4.4	5 700
22 July S	5.0	4.5	6 900
B	5.0	4.8	7 100
29 July S	7.5	3.3	3 680
B	4.5	4.8	4 080
5 Aug. S	6.2	5.7	7 000
B	5.0	11.7	13 000
12 Aug. S	7.5	5.9	6 600
B	3.0	23.7	26 100
19 Aug. S	5.0	18.6	22 300
B	2.0	23.8	28 300
PB015			
9 July S	3.0	4.5	5 200
B	1.0	11.0	12 700
15 July S	5.0	4.4	4 510
B	4.0	5.4	6 000
22 July S	5.0	4.7	6 900
B	5.0	5.6	8 200
29 July S	7.0	2.8	3 210
B	7.0	4.7	4 090
5 Aug. S	5.8	5.1	6 700
B	4.5	6.7	8 000
12 Aug. S	7.5	5.2	6 400
B	3.0	24.8	27 900
19 Aug. S	4.1	17.2	21 700
B	1.8	23.8	29 800

[1] S = Surface; B = Bottom (5 m).

Table A2.1. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 29 June - 7 July 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	48	35	2	6	2							93	29 June
	%	51.6	37.6	2.2	6.5	2.2								S 1245
	CPUE	21.3	15.6	0.9	2.7	0.9								L 1500
PB002	N	40	43	2	7	8	1			1	1		103	29 June
	%	38.9	41.8	1.9	6.8	7.8	1.0			1.0	1.0			S 1230
	CPUE	20.0	21.5	1.0	3.5	4.0	0.5			0.5	0.5			L 1430
PB003	N	39	18	5		2							64	29 June
	%	60.9	28.1	7.8		3.1								S 1200
	CPUE	21.3	9.8	2.7		1.1								L 1350
PB004	N	28	34	7		2			1	2			74	29 June
	%	37.8	46.0	9.5		2.7			1.4	2.7				S 1130
	CPUE	14.0	17.0	3.5		1.0			0.5	1.0				L 1330
PB005	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB006	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB007	N	14	7	1	3	2							27	30 June
	%	51.9	25.9	3.7	11.1	7.4								S 1930
	CPUE	7.0	3.5	0.5	1.5	1.0								L 2030
PB009	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB021	N	29	17		13	18	34				1		112	6 July
	%	25.9	15.2		11.6	16.1	30.4				0.9			S 1310
	CPUE	14.5	8.5		6.5	9.0	17.0				0.5			L 1510
PB011	N	1					1						2	2 July
	%	50.0					50.0							S 1025
	CPUE	1.0					1.0							L 1125
PB012	N												0	2 July
	%													S 1040
	CPUE													L 1140
PB013	N	1					1						2	2 July
	%	50.0					50.0							S 1430
	CPUE	0.7					0.7							L 1600
PB014	N	4	1									1	6	3 July
	%	66.7	16.7									16.7		S 1020
	CPUE	2.0	0.5									0.5		L 1220
PB015	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
Total	N	204	155	17	29	34	37		1	3	2	1	483	995 minutes
	%	42.2	32.1	3.5	6.0	7.0	7.7		0.2	0.6	0.4	0.2		
	CPUE	12.3	9.4	1.0	1.8	2.1	2.2		0.1	0.2	0.1	0.1		

Table A2.2. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 8-14 July 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	6	1		5	7	2				1		22	11 July
	%	27.3	4.5		22.7	31.8	9.1				4.5			S 1040
	CPUE	6.0	1.0		5.0	7.0	2.0				1.0			L 1140
PB002	N	6	6		18	23	2			2	2		59	10 July
	%	10.2	10.2		30.5	39.0	3.4			3.4	3.4			S 1150
	CPUE	6.0	6.0		18.0	23.0	2.0			2.0	2.0			L 1250
PB003	N	61	32			1							94	12 July
	%	64.9	34.0			1.1								S 1035
	CPUE	61.0	32.0			1.0								L 1135
PB004	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB005	N	24											24	9 July
	%	100.0												S 0945
	CPUE	24.0												L 1045
PB006	N	59	3		7	1		1	1				72	10 July
	%	81.9	4.2		9.7	1.4		1.4	1.4					S 1005
	CPUE	59.0	3.0		7.0	1.0		1.0	1.0					L 1105
PB007	N	3	3		3	11					1		21	8 July
	%	14.3	14.3		14.3	52.4					4.8			S 1500
	CPUE	3.0	3.0		3.0	11.0					1.0			L 1600
PB009	N	4			1								5	8 July
	%	80.0			20.0									S 1100
	CPUE	4.0			1.0									L 1200
PB021	N	2			1	2		1		2			8	11 July
	%	25.0			12.5	25.0		12.5		25.0				S 0915
	CPUE	2.0			1.0	1.0		1.0		2.0				L 1015
PB011	N					1							1	8 July
	%					100.0								S 1035
	CPUE					0.5								L 1235
PB012	N												0	8 July
	%													S 1440
	CPUE													L 1640
PB013	N	1											1	12 July
	%	100.0												S 1000
	CPUE	0.5												L 1210
PB014	N												0	9 July
	%													S 1150
	CPUE													L 1300
PB015	N												0	9 July
	%													S 1020
	CPUE													L 1200
Total	N	166	45		35	46	4	2	1	4	4		307	1020
	%	54.1	14.7		11.4	15.0	1.3	0.7	0.3	1.3	1.3			minutes
	CPUE	9.8	2.7		2.1	2.7	0.2	0.1	0.1	0.2	0.2			

Table A2.3. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 15-21 July 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	3	15		3	6	3						30	17 July
	%	10.0	50.0		10.0	20.0	10.0							S 1810
	CPUE	3.0	15.0		3.0	6.0	3.0							L 1910
PB002	N	18	14		3	3							38	20 July
	%	47.4	36.8		7.9	7.9								S 1228
	CPUE	18.0	14.0		3.0	3.0								L 1328
PB003	N	45	25		8	3	3						84	15 July
	%	53.6	29.8		9.5	3.6	3.6							S 1110
	CPUE	45.0	25.0		8.0	3.0	3.0							L 1210
PB004	N	59	12		6	6							83	18 July
	%	71.1	14.5		7.2	7.2								S 0920
	CPUE	59.0	12.0		6.0	6.0								L 1020
PB005	N	157	1	1		1							160	15 July
	%	98.1	0.6	0.6		0.6								S 0950
	CPUE	209.3	1.3	1.3		1.3								L 1035
PB006	N	31	8		6	6	15				2		68	18 July
	%	45.6	11.8		8.8	8.8	22.1				2.9			S 1100
	CPUE	31.0	8.0		6.0	6.0	15.0				2.0			L 1200
PB007	N	28	49		2	5	9						93	18 July
	%	30.1	52.7		2.2	5.4	9.7							S 1453
	CPUE	28.0	49.0		2.0	5.0	9.0							L 1553
PB009	N	15				1	1						17	16 July
	%	88.2				5.9	5.9							S 1045
	CPUE	16.4				1.1	1.1							L 1140
PB021	N		2			2							4	17 July
	%		50.0			50.0								S 1800
	CPUE		2.0			2.0								L 1900
PB011	N		1				1						2	16 July
	%		50.0				50.0							S 1030
	CPUE		0.8				0.8							L 1150
PB012	N				1		3						4	18 July
	%				25.0		75.0							S 1430
	CPUE				0.5		1.5							L 1630
PB013	N	1			2		3						6	15 July
	%	16.7			33.3		50.0							S 1035
	CPUE	0.5			1.0		1.5							L 1235
PB014	N						1						1	18 July
	%						100.0							S 0930
	CPUE						0.5							L 1130
PB015	N												0	15 July
	%													S 1000
	CPUE													L 1200
Total	N	357	127	1	31	33	39				2		590	1080
	%	60.5	21.5	0.2	5.3	5.6	6.6				0.3			minutes
	CPUE	19.8	7.1	0.1	1.7	1.8	2.2				0.1			

Table A2.4. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 22-28 July 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	16	8		1	5				1			31	25 July
	%	51.6	25.8		3.2	16.1				3.2				S 1017
	CPUE	16.0	8.0		1.0	5.0				1.0				L 1117
PB002	N	9	1	1	9	18			1	1			40	25 July
	%	22.5	2.5	2.5	22.5	45.0			2.5	2.5				S 1048
	CPUE	9.0	1.0	1.0	9.0	18.0			1.0	1.0				L 1148
PB003	N	1	7		8	1			1	1			19	23 July
	%	5.3	36.8		42.1	5.3			5.3	5.3				S 1113
	CPUE	1.0	7.0		8.0	1.0			1.0	1.0				L 1213
PB004	N	12		23	3	1		1					40	22 July
	%	30.0		57.5	7.5	2.5		2.5						S 1237
	CPUE	12.0		23.0	3.0	1.0		1.0						L 1337
PB005	N	34	1	6	1	6					3		51	22 July
	%	66.7	2.0	11.8	2.0	11.8					5.9			S 0936
	CPUE	34.0	1.0	6.0	1.0	6.0					3.0			L 1036
PB006	N	17	47		13	4	1		1				83	23 July
	%	20.5	56.6		15.7	4.8	1.2		1.2					S 1232
	CPUE	17.0	47.0		13.0	4.0	1.0		1.0					L 1332
PB007	N	20			1		9						30	24 July
	%	66.7			3.3		29.0							S 1247
	CPUE	20.0			1.0		9.0							L 1347
PB009	N	78	7	1		1			1				88	24 July
	%	88.6	8.0	1.1		1.1			1.1					S 1045
	CPUE	72.0	6.5	0.9		0.9			0.9					L 1150
PB021	N		3		5	3				3	2		16	25 July
	%		18.8		31.3	18.8				18.8	12.5			S 1006
	CPUE		3.0		5.0	3.0				3.0	2.0			L 1106
PB011	N	3											3	24 July
	%	100.0												S 1020
	CPUE	1.4												L 1225
PB012	N		1										1	24 July
	%		100.0											S 1108
	CPUE		0.5											L 1308
PB013	N	15	1				1				1		18	23 July
	%	83.3	5.6				5.6				5.6			S 1058
	CPUE	7.5	0.5				0.5				0.5			L 1258
PB014	N			1	3								4	22 July
	%			25.0	75.0									S 0945
	CPUE			0.6	1.7									L 1155
PB015	N	4											4	22 July
	%	100.0												S 0945
	CPUE	1.8												L 1155
Total	N	209	76	32	44	39	11	1	4	6	6		428	1145
	%	48.8	17.8	7.5	10.3	9.1	2.6	0.2	0.9	1.4	1.4			minutes
	CPUE	11.0	4.0	1.7	2.3	2.0	0.6	0.1	0.2	0.3	0.3			

Table A2.5. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 29 July - 4 August 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	6	27	1	2	8		1	1		2		48	29 July
	%	12.5	56.3	2.1	4.2	16.7		2.1	2.1		4.2			S 1105
	CPUE	6.0	27.0	1.0	2.0	8.0		1.0	1.0		2.0			L 1205
PB002	N	18	10		7	5							40	3 Aug.
	%	45.0	25.0		17.5	12.5								S 1807
	CPUE	18.0	10.0		7.0	5.0								L 1907
PB003	N	29	29	3	5	20	3				3		92	30 July
	%	31.5	31.5	3.3	5.4	21.7	3.3				3.3			S 0115
	CPUE	29.0	29.0	3.0	5.0	20.0	3.0				3.0			L 0215
PB004	N	54	28	4	11	18	4				2		121	29 July
	%	44.6	23.1	3.3	9.1	14.9	3.3				1.7			S 2255
	CPUE	46.3	24.0	3.4	9.4	15.4	3.4				1.7			L 2405
PB005	N	33	29	4	2	1	12						81	29 July
	%	40.7	35.8	4.9	2.5	1.2	14.8							S 2033
	CPUE	33.0	29.0	4.0	2.0	1.0	12.0							L 2133
PB006	N	28	65	1	2	4	1	2	2	1			106	3 Aug.
	%	26.4	61.3	0.9	1.9	3.8	0.9	1.9	1.9	0.9				S 1600
	CPUE	28.0	65.0	1.0	2.0	4.0	1.0	2.0	2.0	1.0				L 1700
PB007	N	14	22		3	10	8						57	30 July
	%	24.6	38.6		5.3	17.5	14.0							S 1802
	CPUE	14.0	22.0		3.0	10.0	8.0							L 1902
PB009	N	21	16	3	1	5		2					48	30 July
	%	43.8	33.3	6.3	2.1	10.4		4.2						S 1543
	CPUE	21.0	16.0	3.0	1.0	5.0		2.0						L 1643
PB021	N	7	3				1						11	29 July
	%	63.6	27.3				9.1							S 1115
	CPUE	6.0	2.6				0.9							L 1225
PB011	N						1						1	30 July
	%						100.0							S 1525
	CPUE						0.5							L 1725
PB012	N												0	30 July
	%													S 1745
	CPUE													L 1945
PB013	N				2	4	6						12	29 July
	%				16.7	33.3	50.0							S 2320
	CPUE				1.0	2.0	3.0							L 0120
PB014	N		2			3	1						6	29 July
	%		33.3			50.0	16.7							S 2050
	CPUE		1.0			1.6	0.5							L 2245
PB015	N												0	29 July
	%													S 2025
	CPUE													L 2225
Total	N	210	231	16	35	78	37	5	3	1	7		623	1155
	%	33.7	37.1	2.6	5.6	12.5	5.9	0.8	0.5	0.2	1.1			minutes
	CPUE	10.9	12.0	0.8	1.8	4.1	1.9	0.3	0.2	0.1	0.4			

Table A2.6. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 5-11 August 1985.

Site		Species Captured										Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR	
PB001	N	31	15									46	10 Aug.
	%	67.4	32.6										S 1120
	CPUE	31.0	15.0										L 1220
PB002	N	18	1	1	4	6		2	2			34	10 Aug.
	%	52.9	2.9	2.9	11.8	17.7		5.9	5.9				S 1248
	CPUE	18.0	1.0	1.0	4.0	6.0		2.0	2.0				L 1348
PB003	N	20	6	1						1		28	9 Aug.
	%	71.4	21.4	3.6						3.6			S 1219
	CPUE	20.0	6.0	1.0						1.0			L 1319
PB004	N	56	8	1	1	2		1				69	9 Aug.
	%	81.2	11.6	1.5	1.5	2.9		1.5					S 0939
	CPUE	56.0	8.0	1.0	1.0	2.0		1.0					L 1039
PB005	N	3	4			8	2					17	5 Aug.
	%	17.7	23.5			47.1	11.8						S 1156
	CPUE	3.0	4.0			8.0	2.0						L 1256
PB006	N	24	8						1			33	9 Aug.
	%	72.7	24.2						3.0				S 1342
	CPUE	24.0	8.0						1.0				L 1442
PB007	N	2	1									3	8 Aug.
	%	66.7	33.3										S 1222
	CPUE	2.0	1.0										L 1322
PB009	N	5	12			4	1					22	8 Aug.
	%	22.7	54.6			18.2	4.6						S 1020
	CPUE	5.0	12.0			4.0	1.0						L 1120
PB021	N	9	4			2	1			2		18	10 Aug.
	%	50.0	22.2			11.1	5.6			11.1			S 1104
	CPUE	9.0	4.0			2.0	1.0			2.0			L 1204
PB011	N											0	8 Aug.
	%												S 1000
	CPUE												L 1200
PB012	N					3	3					6	S 6 Aug. 1135
	%					50.0	50.0						L 7 Aug. 0930
	CPUE					0.1	0.1						
PB013	N											0	9 Aug.
	%												S 1155
	CPUE												L 1355
PB014	N	5			1		1					7	5 Aug.
	%	71.4			14.3		14.3						S 1135
	CPUE	1.1			0.2		0.2						L 1605
PB015	N						3					3	5 Aug.
	%						100.0						S 1120
	CPUE						0.7						L 1530
Total	N	173	59	3	6	25	11	3	3	3		286	2615
	%	60.5	20.6	1.1	2.1	8.7	3.9	1.1	1.1	1.1			minutes
	CPUE	4.0	1.4	0.1	0.1	0.6	0.3	0.1	0.1	0.1			

Table A2.7. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 12-18 August 1985.

Site		Species Captured										Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR	
PB001	N	30	3	1								34	17 Aug.
	%	88.2	8.8	2.9									S 1155
	CPUE	30.0	3.0	1.0									L 1255
PB002	N	38	3	4		4						49	15 Aug.
	%	77.6	6.1	8.2		8.2							S 1155
	CPUE	38.0	3.0	4.0		4.0							L 1255
PB003	N	52	2			3						57	15 Aug.
	%	91.2	3.5			5.3							S 1010
	CPUE	52.0	2.0			3.0							L 1110
PB004	N	14	7	1	1	4		2				29	12 Aug.
	%	48.3	24.1	3.5	3.5	13.8		6.9					S 1256
	CPUE	14.0	7.0	1.0	1.0	4.0		2.0					L 1356
PB005	N	19	5	4		3						31	12 Aug.
	%	61.3	16.1	12.9		9.7							S 1030
	CPUE	19.0	5.0	4.0		3.0							L 1130
PB006	N	45	11	1	7	9	3		1		1		78	13 Aug.
	%	57.7	14.1	1.3	9.0	11.5	3.9		1.3		1.3		S 1003
	CPUE	45.0	11.0	1.0	7.0	9.0	3.0		1.0		1.0		L 1103
PB007	N	31	3			8						42	14 Aug.
	%	73.8	7.1			19.1							S 1235
	CPUE	31.0	3.0			8.0							L 1335
PB009	N	10	1		1	1	1					14	14 Aug.
	%	71.4	7.1		7.1	7.1	7.1						S 1017
	CPUE	10.0	1.0		1.0	1.0	1.0						L 1117
PB021	N	11				1						12	17 Aug.
	%	91.7				8.3							S 1138
	CPUE	11.0				1.0							L 1238
PB011	N											0	14 Aug.
	%												S 1000
	CPUE												L 1200
PB012	N					1						1	14 Aug.
	%					100.0							S 1219
	CPUE					0.5							L 1419
PB013	N					5						5	13 Aug.
	%					100.0							S 0930
	CPUE					2.5							L 1130
PB014	N											0	12 Aug.
	%												S 1220
	CPUE												L 1420
PB015	N	3										3	12 Aug.
	%	100.0											S 1013
	CPUE	1.7											L 1158
Total	N	253	35	11	9	39	4	2	1		1	355	1125
	%	71.3	9.9	3.1	2.5	11.0	1.1	0.6	0.3		0.3		minutes
	CPUE	13.5	1.9	0.6	0.5	2.1	0.2	0.1	0.1		0.1		

Table A2.8. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in gillnets at each sampling location, Phillips Bay, 19-21 August 1985.

Site		Species Captured											Total	Date and Time Set (S) and Lifted (L)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	BDWT	LKWT	INCO	SFCD	PCHR		
PB001	N	17	1			1							19	21 Aug.
	%	89.5	5.3			5.3								S 0958
	CPUE	17.0	1.0			1.0								L 1058
PB002	N	49	2	4		1							56	21 Aug.
	%	87.5	3.6	7.1		1.8								S 1126
	CPUE	49.0	2.0	4.0		1.0								L 1226
PB003	N	11	1	4		5							21	19 Aug.
	%	52.4	4.8	19.1		23.8								S 1538
	CPUE	11.0	1.0	4.0		5.0								L 1638
PB004	N	19	3	4		2							28	19 Aug.
	%	67.9	10.7	14.3		7.1								S 1159
	CPUE	19.0	3.0	4.0		2.0								L 1259
PB005	N	39	4	5		3							51	19 Aug.
	%	76.5	7.8	9.8		5.9								S 0958
	CPUE	39.0	4.0	5.0		3.0								L 1058
PB006	N	20			3	1							24	19 Aug.
	%	83.3			12.5	4.2								S 1708
	CPUE	20.0			3.0	1.0								L 1808
PB007	N	17		2			1						20	20 Aug.
	%	85.0		10.0			5.0							S 1536
	CPUE	17.0		2.0			1.0							L 1636
PB009	N	1	1	2	1		1						6	20 Aug.
	%	16.7	16.7	33.3	16.7		16.7							S 1017
	CPUE	1.0	1.0	2.0	1.0		1.0							L 1117
PB021	N	2	2										4	21 Aug.
	%	50.0	50.0											S 0941
	CPUE	2.0	2.0											L 1041
PB011	N												0	20 Aug.
	%													S 0958
	CPUE													L 1158
PB012	N												0	20 Aug.
	%													S 1514
	CPUE													L 1714
PB013	N					1							1	19 Aug.
	%					100.0								S 1347
	CPUE					0.5								L 1547
PB014	N												0	19 Aug.
	%													S 1133
	CPUE													L 1333
PB015	N												0	19 Aug.
	%													S 0935
	CPUE													L 1140
Total	N	175	14	21	4	14	2						230	1145
	%	76.1	6.1	9.1	1.7	6.1	0.9							minutes
	CPUE	9.2	0.7	1.1	0.2	0.7	0.1							

Table A3.1. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 29 June - 7 July 1985.

Site		Species Captured											Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N	2	4	1	14	18	6						45	201
	%	4.4	8.9	2.2	31.1	40.0	13.3							
	CPUE	1.0	2.0	0.5	7.0	9.0	3.0							
PB002	N		3			1	1						5	45
	%		60.0			20.0	20.0							
	CPUE		6.7			2.2	2.2							
PB003	N	2			2								4	65
	%	50.0			50.0									
	CPUE	3.1			3.1									
PB004	N			1		2							3	60
	%			33.3		66.7								
	CPUE			1.7		3.3								
PB005	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB006	N												0	21
	%													
	CPUE													
PB066	N												0	62
	%													
	CPUE													
PB007	N	1	1		7		1						10	56
	%	10.0	10.0		70.0		10.0							
	CPUE	1.8	1.8		12.5		1.8							
PB008	N			5	9	1	9						24	65
	%			20.8	37.5	4.2	37.5							
	CPUE			7.7	13.8	1.5	13.8							
PB009	N					1							1	25
	%					100.0								
	CPUE					4.0								
PB010	N	2		1									3	54
	%	66.7		33.3										
	CPUE	3.7		1.9										
Total	N	7	8	8	32	23	17						95	654
	%	7.4	8.4	8.4	33.7	24.2	17.9							
	CPUE	1.1	1.2	1.2	4.9	3.5	2.6							

Table A3.2. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 8-14 July 1985.

Site		Species Captured										Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N	209											209	55
	%	100.0												
	CPUE	380.0												
PB002	N		1		15	5	8						29	155
	%		3.4		51.7	17.2	27.6							
	CPUE		0.6		9.7	3.2	5.2							
PB003	N	3	2			2	2						9	115
	%	33.3	22.2			22.2	22.2							
	CPUE	2.6	1.7			1.7	1.7							
PB004	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB005	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB006	N				1		1						2	82
	%				50.0		50.0							
	CPUE				1.2		1.2							
PB066	N				2	33							35	47
	%				5.7	94.3								
	CPUE				4.3	70.2								
PB007	N	9	6			1							16	133
	%	56.3	37.5			6.3								
	CPUE	6.8	4.5			0.8								
PB008	N	3				38							41	80
	%	7.3				92.7								
	CPUE	3.8				47.5								
PB009	N	3				2							5	138
	%	60.0				40.0								
	CPUE	2.2				1.4								
PB010	N	4				40							44	134
	%	9.1				90.9								
	CPUE	3.0				29.9								
Total	N	231	9		18	121	11						390	939
	%	59.2	2.3		4.6	31.0	2.8							
	CPUE	24.6	1.0		1.9	12.9	1.2							

Table A3.3. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 15-21 July 1985.

Site		Species Captured										Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N	6				7							13	137
	%	46.2				53.9								
	CPUE	4.4				5.1								
PB002	N	1			1	5							7	142
	%	14.3			14.3	71.4								
	CPUE	0.7			0.7	3.5								
PB003	N					6							6	68
	%					100.0								
	CPUE					8.8								
PB004	N	5	1										6	110
	%	83.3	16.7											
	CPUE	4.5	0.9											
PB005	N	2	-										2	102
	%	100.0												
	CPUE	2.0												
PB006	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB066	N	3	1		4	9		1					18	103
	%	16.7	5.6		22.2	50.0		5.6						
	CPUE	2.9	1.0		3.9	8.7		1.0						
PB007	N					19							19	150
	%					100.0								
	CPUE					12.7								
PB008	N	1				2							3	47
	%	33.3				66.7								
	CPUE	2.1				4.3								
PB009	N	2				2							4	76
	%	50.0				50.0								
	CPUE	2.6				2.6								
PB010	N	1				12							13	77
	%	7.7				92.3								
	CPUE	1.3				15.6								
Total	N	21	2		5	62		1					91	1012
	%	24.1	2.2		5.5	68.1		1.1						
	CPUE	2.1	0.2		0.5	6.1		0.1						

Table A3.4. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 22-28 July 1985.

		Species Captured											Shoreline
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSK	ARGR	PCSN	(m)
PB001	N	26			2	14	2					44	63
	%	59.1			4.6	31.8	4.6						
	CPUE	41.3			3.2	22.2	3.2						
PB002	N	31	4			4	1					40	94
	%	77.5	10.0			10.0	2.5						
	CPUE	33.0	4.3			4.3	1.1						
PB003	N	5				89	31					125	123
	%	4.0				71.2	24.8						
	CPUE	4.1				72.4	25.2						
PB004	N	21				11	2					34	133
	%	61.8				32.4	5.9						
	CPUE	15.8				8.3	1.5						
PB005	N					87						87	105
	%					100.0							
	CPUE					82.9							
PB006	N					6						6	66
	%					100.0							
	CPUE					9.1							
PB066	N	411			1	323	1					739[1]	40
	%	55.6			0.1	43.7	0.1						
	CPUE	1027.5			2.5	807.5	2.5						
PB007	N	23				53						76	67
	%	30.3				69.7							
	CPUE	34.3				79.1							
PB008	N	9			1	7	5					22	125
	%	40.9			4.6	31.8	22.7						
	CPUE	7.2			0.8	5.6	4.0						
PB009	N	10	6			89	1					106	77
	%	9.4	5.7			84.0	0.9						
	CPUE	13.0	7.8			115.6	1.3						
PB010	N	1	1			3	12					17	84
	%	5.9	5.9			17.7	70.6						
	CPUE	1.2	1.2			3.6	14.3						
Total	N	537	11		4	686	55					1296[1]	977
	%	41.4	0.9		0.3	52.9	4.2						
	CPUE	55.0	1.1		0.4	70.2	5.6						

[1]Includes three unidentified specimens.

Table A3.5. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 29 July - 4 August 1985.

Site		Species Captured										Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N	160	3		1	1							165	90
	%	97.0	1.8		0.6	0.6								
	CPUE	177.8	3.3		1.1	1.1								
PB002	N	162	14	1		7	6		1				191	80
	%	84.8	7.3	0.5		3.7	3.1		0.5					
	CPUE	202.5	17.5	1.3		8.8	7.5		1.3					
PB003	N	3			1	11	1						16	67
	%	18.8			6.3	68.8	6.3							
	CPUE	4.5			1.5	16.4	1.5							
PB004	N	5				25	5						35	85
	%	14.3				71.4	14.3							
	CPUE	5.9				29.4	5.9							
PB005	N	3				33	4						40	131
	%	7.5				82.5	10.0							
	CPUE	2.3				25.2	3.1							
PB006	N		2			1							3	74
	%		66.7			33.3								
	CPUE		2.7			1.4								
PB066	N				1	83							84	32
	%				1.2	98.8								
	CPUE				3.1	259.4								
PB007	N	65	1			3							69	109
	%	94.2	1.5			4.4								
	CPUE	59.6	0.9			2.8								
PB008	N	42				16	2						60	97
	%	70.0				26.7	3.3							
	CPUE	43.3				16.5	2.1							
PB009	N	17	1										18	125
	%	94.4	5.6											
	CPUE	13.6	0.8											
PB010	N	54	2			2							58	131
	%	93.1	3.5			3.5								
	CPUE	41.2	1.5			1.5								
Total	N	511	23	1	3	182	18		1				739	1021
	%	69.2	3.1	0.1	0.4	24.6	2.4		0.1					
	CPUE	50.0	2.3	0.1	0.3	17.8	1.8		0.1					

Table A3.6. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 5-11 August 1985.

Site		Species Captured											Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N	973	83			2	1						1059	33
	%	91.9	7.8			0.2	0.1							
	CPUE	2948.5	251.5			6.1	3.0							
PB002	N	7	1			4							12	102
	%	58.3	8.3			33.3								
	CPUE	6.9	1.0			3.9								
PB003	N	199	20			21	3						243	103
	%	81.9	8.2			8.6	1.2							
	CPUE	193.2	19.4			20.4	2.9							
PB004	N	1	3			2	4						10	103
	%	10.0	30.0			20.0	40.0							
	CPUE	1.0	2.9			1.9	3.9							
PB005	N	7				2	13					1	23	103
	%	30.4				8.7	56.5					4.4		
	CPUE	6.8				1.9	12.6					1.0		
PB006	N	17	4			6							27	56
	%	63.0	14.8			22.2								
	CPUE	30.4	7.1			10.7								
PB066	N	3				43							46	50
	%	6.5				93.5								
	CPUE	6.0				86.0								
PB007	N	1	1		1	56	4						63	82
	%	1.6	1.6		1.6	88.9	6.4							
	CPUE	1.2	1.2		1.2	68.3	4.9							
PB008	N		5		10	11							26	74
	%		19.2		38.5	42.3								
	C/E		6.8		13.5	14.9								
PB009	N	3	9										12	96
	%	25.0	75.0											
	CPUE	3.1	9.4											
PB010	N	27	11		3	1							42	98
	%	64.3	26.2		7.1	2.4								
	CPUE	27.6	11.2		3.1	1.0								
Total	N	1238	137		14	148	25					1	1563	900
	%	79.2	8.8		0.9	9.5	1.6					0.1		
	CPUE	137.6	15.2		1.6	16.4	2.8					0.1		

Table A3.7. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 12-18 August 1985.

Site		Species Captured										Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSB	ARGR	PCSN		
PB001	N					15	1						16	97
	%					93.8	6.3							
	CPUE					15.5	1.0							
PB002	N	9				82	1						92	89
	%	9.8				89.1	1.1							
	CPUE	10.1				92.1	1.1							
PB003	N	1											1	63
	%	100.0												
	CPUE	1.6												
PB004	N	93	8			2							103	87
	%	90.3	7.8			1.9								
	CPUE	106.9	9.2			2.3								
PB005	N	71	11							1			83	79
	%	85.5	13.3							1.2				
	CPUE	89.9	13.9							1.3				
PB006	N	4			2								6	54
	%	66.7			33.3									
	CPUE	7.4			3.7									
PB066	N	28	1			3							32	38
	%	87.5	3.1			9.4								
	CPUE	73.7	2.6			7.9								
PB007	N					4	1						5	81
	%					80.0	20.0							
	CPUE					4.9	1.2							
PB008	N	3											3	56
	%	100.0												
	CPUE	5.4												
PB009	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	CPUE													
PB010	N	87	22			1							110	42
	%	79.1	20.0			0.9								
	CPUE	207.1	52.4			2.4								
Total	N	296	42		2	107	3			1			451	686
	%	65.6	9.3		0.4	23.7	0.7			0.2				
	CPUE	43.1	6.1		0.3	15.6	0.4			0.1				

Table A3.8. Numbers (N), percentage (%) and catch-per-unit-effort (CPUE) for fish captured in seines at each sampling location, Phillips Bay, 19-21 August 1985.

Site		Species Captured										Total	Shoreline Seined (m)
		ARCS	LSCS	CHAR	ARFL	FHSC	RNSM	LKWT	INCO	NSSR	ARGR	PCSN		
PB001	N	18	5			1	1			1			26	82
	%	69.2	19.2			3.9	3.9			3.9				
	CPUE	22.0	6.1			1.2	1.2			1.2				
PB002	N	7				1							8	99
	%	87.5				12.5								
	CPUE	7.1				1.0								
PB003	N	23	3			10							36	99
	%	63.9	8.3			27.8								
	CPUE	23.2	3.0			10.1								
PB004	N	3											3	99
	%	100.0												
	CPUE	3.0												
PB005	N	5											5	97
	%	100.0												
	CPUE	5.2												
PB006	N	3	1			7	1						12	63
	%	25.0	8.3			58.3	8.3							
	CPUE	4.8	1.6			11.1	1.6							
PB066	N					17							17	31
	%					100.0								
	CPUE					54.8								
PB007	N	1				56							57	79
	%	1.8				98.3								
	CPUE	1.3				70.9								
PB008	N	4	1		1	4					1		11	91
	%	36.4	9.1		9.1	36.4					9.1			
	CPUE	4.4	1.1		1.1	4.4					1.1			
PB009	N	3											3	76
	%	100.0												
	CPUE	3.9												
PB010	N	25	5			1	1						33[1]	51
	%	75.8	15.2			3.0	3.0							
	CPUE	49.0	9.8			2.0	2.0							
Total	N	92	15		1	97	3			1	1		211	867
	%	43.6	7.1		0.5	46.0	1.4			0.5	0.5			
	CPUE	10.6	1.7		0.1	11.2	0.3			0.1	0.1			

[1] Includes one unidentified specimen.